Forest Inventory Permanent Sample Plot Field Measurement Methods And Specifications

---

A system of permanent sample plots randomly located throughout the forests of the Province of Nova Scotia

NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES
Renewable Resources Branch, Forestry Division, Forest Inventory Section

April 10, 2002
Version 2002 - 1.1

TABLE OF CONTENTS

Chapter 1: HISTORY 4
- 1.1 Introduction 4
- 1.2 Overview 4
- 1.3 Selection Process for new forest inventory plots 5
- 1.4 Future 6

Chapter 2: ESTABLISHMENT AND RE-MEASUREMENT METHODS 8
- 2.1 Plot establishment/re-establishment 8
- 2.2 Plot measurement methods and recording 10
- 2.3 Live tree data 12
- 2.4 Dead standing tree data 12
- 2.5 Sapling data 13
- 2.6 Additional plot data 13
- 2.7 Duff, soil drainage and rock information 14
- 2.8 Ground cover and vegetation 14
- 2.9 Dead standing saplings 14
- 2.10 Dead standing woody vegetation 15
- 2.11 Down coarse woody debris 15

Chapter 3: MEASUREMENT SPECIFICATIONS 16
- 3.1 Introduction 16
- 3.2 PDR selection of plot 16
- 3.3 Measurement of standing live trees in FIP 17
- 3.4 Tree definition and diameter 18
- 3.5 Softwood product codes for living trees 22
- 3.6 Hardwood product codes for living trees 24
- 3.7 Hardwood sawlog data for grading: 25
- 3.8 Tree height measurements 32
- 3.9 Dead standing tree measurements 33
- 3.10 Sapling data 35
- 3.11 Plot data 36
- 3.12 Duff depth, soil drainage and rock information 38
- 3.13 Ground cover and vegetation 39
- 3.14 Woody vegetation in 10 m^2 subplot 41
- 3.15 Dead standing vegetation for saplings 42
- 3.16 Dead standing vegetation for woody vegetation 43
- 3.17 Down, coarse, woody debris 43

LIST OF APPENDICES

APPENDIX I 45
Tree and Woody Shrub Latin Names 46

APPENDIX II 48
Field Tally Sheets 49

APPENDIX III 56
Cruising Aids 57

APPENDIX IV .....
Damage Agents: Forests Pests (Not included): .....

APPENDIX V 63
Locating and Collecting Coordinates using GPS with the March II units 64

Chapter 1: HISTORY

1.1 INTRODUCTION

The Forest Inventory Permanent Sample Plot Program is based on a 0.04 hectare fixed area circular plot located by a centre pin and boundary trees. The initial purpose of this continuous forest inventory monitoring system was to enable the determination of growth and mortality of the natural forest within this plot. This program in Nova Scotia was expanded in 1998 to measure more plots and more variables within these Forest Inventory Plots (FIPs), which will help Nova Scotia report on a wider range of criteria and indicators. This will also permit better tracking of some aspects of our forest's bio-diversity and sustainability. These specifications were developed for the re-measure of the current FIPs. In addition, it covers the establishment procedures for 2139 new FIPs.

1.2 OVERVIEW

From 1965 to 1970 inclusive, the province established 1765 FIPs throughout the province (also referred to as Permanent Sample Plots or PSPs). These plots, randomly selected using latitudes and longitudes, were established over the entire province. During each of the six years, 250 to 420 PSPs were established as shown in Table 1. Plots were subsequently re-measured every 5 years.

In 1996, after a review of present and future data requirements, it was decided to expand the Forest Inventory Plot system. The reason for the increase in sample size was to improve the precision of merchantable volume estimates. The variation in merchantable volume was calculated for established plots with an average age of 41 + years. This variance allowed us to compute the plots required to estimate total volume to within 0.5 m^3/plot ($\pm$12 m^3/ha) with 90% confidence. The computations indicated that the number of plots should be doubled from ~1765 to 3500 plots (Table 1). However, in 1999, a review of government programs resulted in the recommended reduction in plot numbers to 3250 plots.

Table 1. Establishment and re-measure year by plot number.

30 Year Old Plots (~1765)		New Plots (~1035)		Both (~2800)
Year of Establishment	**Plot Numbers (#)**	**New Plots* to be Established (Est)**	**Year**	**Plots**
1965 & 1970	1-0251, 1591-1765 (381)	4001 - 4415 (270)	2000	651
1966	0252 - 0504 (227)	5001 - 5594 (424)	2001	651
1967	0505 - 0755 (228)	6001 - 6584 (321)	2002	549
1968	0756 - 1171 (384)	2001 - 2403 Act-309	1998	695
1969	1172 - 1590 (389)	3001 - 3404 Act-316	1999	704
All	1609 old	1641 new	All	3250

*New Plot numbers are selected from this range of plot numbers.
This table is will be in development until all new plots are established. Some of the new plots established in 1998 & 1999 will be re-measured after 4 years, as it is planned to measure 650 plots each year.

The plot expansion occurs in two ways, first, the number of plots is increased to permit more accurate volume estimates, and secondly, there is an increase in the number of "non-timber" variables collected at each plot. Many of these "non-timber" variables have previously been collected on temporary sample plots. The expanded program calls for approximately 650 FIPs to be measured each year with a 5 year revisit schedule. The new plots will be randomly selected over the forested area of the province. Each year, new plots will be established across the province as the old plots are re-measured, until the required number of FIPs is attained.

1.3 SELECTION PROCESS FOR NEW FOREST INVENTORY PLOTS

Using the Geographic Information System (GIS), a 250 m grid square was created. Each grid square was assigned a point number. A list of random numbers were processed against this point list and random grid intersections were selected. The point at the centre of these grid squares (coordinates) were then overlayed on the forest database and if they fell on an area/stand classed as forested, the point would become a new plot centre.

For those points that fall into the "Other Small Private" ownership category, the name of the owner in which these points fall will be determined from the Department of Housing & Municipal Affairs ownership database. All non-Crown owners where potential plots are to be established will be contacted by letter outlining the program and notifying them that a forest inventory plot will be established on their land. In addition, if landowners have any questions or concerns, they will be encouraged to contact the Department.

103-06706/

1.4 FUTURE

Data from the Forest Inventory Plots gives empirical evidence from each plot every 5 years. By combining old and new data, it is possible to look at change over time. This change can then be framed by parameters such as ownership, cover type, land capability etc. and give us insight into the dynamics of our forests. It is anticipated that many stakeholders will be using information from the FIPs. This use will range from reporting information for the Atlantic Maritime Ecozone of Canada's New National Forest Inventory to the production of mensurational reports for large landowners. The data from the FIPs is invaluable. In the realm of resource management in Nova Scotia, there are a number of areas that can benefit from the FIP data. The following is a list of the areas and benefits.

Area	Benefit
Biodiversity	Report on the availability of ecosystem structures and processes that are required to maintain and enhance natural biodiversity. This data includes age class descriptions, forest species composition, and downed and standing dead wood and will be used to prescribe management actions at both the ecosystem and stand level.
Ecosystem Management	Report on the occurrence of forest communities and their physical environment including soils, climate and topography. This data can be used to help assess the long term sustainablility of forest ecosystems and the conservation of natural bio-diversity. Management implications can be made for silviculture and wildlife habitat.
Forest Inventory	Report on Live Forest Volume, increment, harvest, mortality by various classifications such as region, ownership, cover type, land capability, age class etc. Provide information for part of the Atlantic Maritime Ecozone of Canada's New National Forest Inventory to the federal government in order to meet obligations of maintaining a National Forest Database.
Forest Protection	Fire: Report on volumes of fuel types beneath cover types by age class in regions or ecosystems. Pests: Report on forest damage by agent and ecosystem or cover type.
Wildlife Habitat	Report on description and relationships within forest cover, at the tree level, sapling, vegetation or ground cover level.

Additional

The data will be used to report on sustainable forest management issues as they pertain to the CCFM, Criteria and Indicators process.
There is also reporting under the National Forest Accord and the Biodiversity Convention.

Chapter 2: ESTABLISHMENT AND RE-MEASUREMENT METHODS

2.1 PLOT ESTABLISHMENT/RE-ESTABLISHMENT

Plot Centre Location

The plots will be marked on a 1:10,000 base map, and necessary maps and photos will be provided to enable the field crew to plan their access. The cruiser will first establish a tie line on a 1:10,000 base map, and photograph. The crew will get as close to the plot as possible using motorized carriers (e.g. truck, ATV, boat, etc) before proceeding into the woods. Following the tie line, the cruiser will chain to the proposed plot location and establish a centre-stake at the point where the forestry assistant reaches the designated distance. In addition, Global Positioning System (GPS) technology will be used. Each new plot will be given, from the GIS, a 6 degree UTM NAD83 coordinate. This will be entered into the GPS unit and the crew will hold the unit at the plot centre. If the GPS unit (uncorrected) indicates that the centre stake appears to be within 40 m of the GIS coordinates location, and the cruiser is content that the centre stake is in the correct physical location, the plot shall be established. If the cruiser feels that they are not at the correct location, then the cruiser should offset to a known landmark, identifiable on the photograph, plot a new tie line and proceed by the new bearing and distance to the appropriate location, then repeat the GPS check.

Plots must be entirely located within a productive Forest Database Stand. If the plot extends into a non-forested stand, it will be moved no more than the radius of the plot to place it within the productive forest stand. If the plot crosses into another productive forest stand, the cruiser should establish the plot as located. Plots may be moved if the cruiser feels its location may provoke future problems. Examples of this are plots within view of public areas, walkways, or private houses. These plots may be moved (check with supervisor if unsure). To move a plot, the cruiser will compass perpendicular to the sensitive area for 50, 100 or 150 metres (the minimum necessary) until outside of view. The cruiser should not be concerned if the plot leaves the original stand, as long as it is still located in a forested area. If the cruiser must move more than 150 metres, or if the movement results in the plot being located in a non-forest area, then this plot will be dropped. HOWEVER, consult with supervisor to confirm.

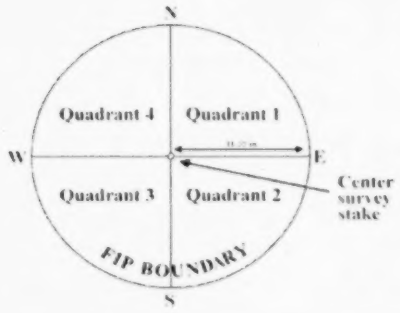
There are roads, streams, etc. too small to have been separated from forest stands in the GIS database and plot coordinates may fall on a non-forest area within a Forest Database Stand. The plot will be moved so that the entire plot is in a forested area. This is to be accomplished by proceeding in the direction of travel, the minimum distance necessary, which will bring the plot entirely into a forested area.

Plot Centre Marking

The first step, once the plot centre has been identified, is to proceed to witness the exact location of the centre stake. This will be completed using two tapes stretched between four witness features, such as trees, rocks, etc. (of a permanent nature), so that the point where the tapes cross is over the exact plot centre. The witness features are to be painted on the side facing the centre stake.

The centre stake will be metal with an aluminum cap identifying the Department of Natural Resources, that it is a Forest Inventory Plot and the plot number. The GPS unit will then be placed on top of the established stake and, when at least 4 satellites (with acceptable strength signals) are available, the location shall be captured by the GPS unit.

When re-measuring established plots, the cruiser should ensure all identifying marks are re-painted, especially the witness features. The cruiser should also take advantage of any opportunity to improve the plot definition.



Plot Sketch

A sketch based on a 1:10000 photograph will be made showing the location of the plot as well as road names, trails, etc., that were used to reach the plot, and indicating where the crew entered the woods to reach the plot (Tally sheet # 8). Any information that may assist in the relocation of the tie point should be recorded on the sketch. The sketch should also contain the plot number, plot centre coordinates, cruiser #, date the sketch was made, and any other relative data that will assist in relocation. The witness feature location is recorded on the Sapling Tally sheet # 2. The location of the plot will be pinpointed on the most recent air photo, along with the plot number and map sheet printed on the back of the photo. This photo will remain in the plot file for future reference.

Plots located in cut-overs and young stands, with few merchantable trees, may be difficult to relocate even with GPS technology. A wooden stake liberally painted and placed beside the metal centre stake is recommended and will assist in the relocation of such plots. Every effort must be made to link these plots to some tie point with accurate bearings and distances. Stumps and/or rocks in the plot area should be liberally painted to aid in the location of the plot and the centre stake. The sketch should precisely identify how the plot is tied and what was done to assist in visibility. Proper marking of these plots will save time and ensure the plot is not lost. There can never be too much information on the plot sketch.

When re-measuring established plots, the original sketch should be updated with new information or replaced as the situation warrants. If the sketch is outdated, or, if a new road provides easier access from a new direction, then a new plot sketch should be drafted. The old one should be archived in the plot file.

Plot Marking

The first step in plot marking is to identify the boundary by measuring the plot radius. Plots are 0.0404 ha (0.1 ac.) with a horizontal radius of 11.35 m. The radius will be measured using a tape and measuring 11.35 m from the centre stake. If the plot falls on a side hill the plot tape must be kept horizontal. Beginning at the centre of the plot, place the tape under the arm and walk outward to the edge of the plot in a straight line, This first measurement is always to be in a Mag. N. direction. For those plots which fall on side hills which are too steep to measure border line trees with a horizontal tape, the following procedure will be used: Determine the degree of slope using a relascope/sunto etc. and refer to the slope correcting table in Appendix IV. Correcting for slope using the tables will only be necessary where slope exceeds 20%. This table will give the radius to be used measuring slope distance. This has to be done for every border measurement since the degree of slope will change as one moves around the border. Mark the boundary of the plot with blue paint; painting trees, rocks, etc., just outside the plot boundary with a # or X.

When re-measuring established plots, it is important to check the distance to any boundary tree which may be suspect, with a length tape. Try to re-apply the new paint over the old paint to reduce confusion.

2.2 PLOT MEASUREMENT METHODS AND RECORDING

General

The data gathered on the plot will be recorded in Portable Data Recorders (PDR). Data will be uploaded upon plot completion or within one week, whichever comes first. The uploaded information should be copied to the Inventory Section local area network within one week of recording PDR information. During the measuring of some variables, a tally sheet may be used to record certain data sets, which will be entered into the PDR as soon as the measurements are

complete. Field crews will carry tally sheets (Appendix II) for all aspects of plot data recording in case of a failure of the PDR. The following information in this chapter describes the data collection methods. The detailed data collection specifications follow in Chapter 3.

Plot Definition

When the cruiser is ready to measure the plot, the plot number must be entered in the PDR and the data relative to the plot will appear on the PDR screen. The cruiser will be asked to review and confirm information on the date, county, region and owner. This information should only be challenged if the cruiser is sure of an error.

Clearcuts

The PDR will ask "clearcut" If the cruiser chooses yes, the PDR will not require you to fill in information for all the trees measured on the plot 5 years ago. This is a housekeeping item, as yes will cause the PDR to drop the history of all trees measured on the plot 5 years ago. If no is selected, all trees measured 5 years ago will require data. If, in fact, a tree has been cut, then entering a code 4 as the "STATUS" code will achieve the same result.

Tree Identification

All standing (living and dead) trees 9.1 cm or larger in diameter at breast height will be numbered with both paint and metal tags. A ribbon will be hung at each cardinal point (N, E, S, W) to aid in identifying the quadrant for tree location. A stick 1.3 m in length will be cut and used to measure breast height from the high side of the ground on each tree. At this 1.3 m breast height, a blue horizontal line will be painted on the side of the tree facing plot centre. Trees that have a fork which is below 1.3 m will be counted as two individual trees. Those trees that fork above 1.3 m will be considered one tree. All standing live and dead trees of merchantable size will be marked with a tree number painted in blue paint above the DBH line, and facing the plot centre. Trees will be numbered starting with #1 at the centre stake and moving northward to the plot boundary, then moving to the right and working back to the centre, and then proceeding to the right again and working to the plot boundary and so on until the plot area has been covered. Trees will also be tagged with the tree number in the root collar **BELOW** the stump height. The tags will be made from an aluminum strip approximately 4 cm long, numbered with a Dymo© Writer and attached to the tree with a 1½" common galvanized nail driven 1" into the root collar. It is imperative that the nail be low enough to avoid any future contact with a chainsaw. Tree tags will be facing the plot centre.

When re-measuring established plots, new trees will be added starting from the highest (last) numbered tree in the plot, and continuing clockwise until all are added.

2.3 LIVE TREE DATA

The following is a description of information gathered at the plot. The actual specifications for these measurements follow in the next chapter. When re-measuring established plots, any modifications (for example species) will have an impact on the entire historic database. It is important to record all information accurately. If a modification is required, then file amendment forms (Appendix II - Tally sheets) must be filled out in order to modify the database. All information is recorded on a Portable Data Recorder (PDR), however tally sheets should be carried at all times. Two tally sheets should be completed on every plot: Tally sheets #2 & #3 - Saplings, and Ground Cover and Vegetation, should be completed before entry into the PDR, and later kept in its FIP file. The PDR routine can be found in Appendix III.

Trees to be tallied will be measured or classified with the following data:

1) Tree number
2) Species
3) Tree status (live, dead, etc)
4) DBH to 0.1 cm
5) Quadrant location of tree
6) Damage agents noted on tree
7) Main product for tree
8) Total tree height to top of live crown (to within 0.1 m)
9) Height to base of live crown ($\pm$ 0.1 m)
10) Health of tree
11) Crown class

2.4 DEAD STANDING TREE DATA

All trees standing between 45° and 90° (the angle measured from ground to the bole), attached to the stump and $\geq$ 9.1 cm DBH will be numbered as described earlier. The following information will be recorded.

i Tree number
ii Species
iii DBH to 0.1 cm
iv Status
v Quadrant location in which tree is located
vi Top diameter (cm)
vii Decay class

viii Carpenter ants
ix Cause of death
x Lean angle (degrees)
xi Tree height (m)

2.5 SAPLING DATA

All live saplings in the 4, 6, and 8 cm DBH classes will be counted by species and average height (both commercial and non-commercial tree and woody plants as per Appendix I) and recorded on Tally sheet # 2. As the saplings are measured, a dot of blue paint will be put on each one to ensure it is not measured twice, nor that any saplings are missed. This is a dot tally of each individual tree by species.

2.6 ADDITIONAL PLOT DATA

Land Capability

Three trees will be chosen and measured for land capability. All three trees should be of the same species and should be dominant, of the majority species, and appear to be and have been free growing with no indication of top damage. In addition, the trees must be larger than 3.1 cm at 1.3 m. Trees may be selected outside of the plot, but inside the stand if no suitable trees are available on the plot. If the plot falls on a micro site, then trees should not be chosen which would be on a better or worse micro site. If trees are selected off the plot, then record the bearing and distance to the tree, assign the tree a letter (A , B, C) and paint the letter on each tree facing the plot centre. When entering these off-plot capability trees in the PDR, use the numbering sequence 555, 556 and 557. For stands without trees 3.1 cm DBH or larger, no measurements are required and the photo interpreted land capability value will be used.

The total height to within 0.1 m and age at DBH will be recorded. Age is extremely important, if there is any difficulty in counting the rings, the increment cores should be extracted from the appropriate tree, inserted into the storage container, labelled as to plot number, tree number, and species, and returned to the office for ring counting. Forest capability need not be computed. It is permissible to use a tree measured for plot age as the capability tree if it meets the specifications.

Average Age of Plot Merchantable Trees

Three trees closest to the diameter of the tree of average basal area of the plot will be measured for breast height age and recorded. The PDR will calculate the tree of average basal area and display tree numbers in descending order from the diameter of tree of average basal area. From this display the appropriate trees will be selected for boring.

The increment cores will be extracted from the appropriate tree, inserted into the storage container, labelled as to plot number, tree number, and species, and returned to a field office for ring counting. This process will be done on each FIP over the next 5 years, following which it will not be repeated until a major change in stand structure occurs.

In young and regeneration stands, the age will be determined by finding three representative saplings and counting the branch whorls to determine the age at breast height. These three trees should be on the plot and be representative of tree heights on the plot.

2.7 DUFF, SOIL DRAINAGE AND ROCK INFORMATION

This information is collected to represent the entire 0.04 ha plot. Information is assessed and recorded on duff depth, soil drainage, surface stoniness and amount of bedrock.

2.8 GROUND COVER AND VEGETATION

The ground cover will be estimated following live tree measurements. This will ensure the cruiser will have walked around the plot and developed an understanding of the ground cover present. The cruiser establishes a 10 m^2 plot to measure all living woody vegetation smaller than sapling size. To establish this plot the cruiser travels magnetic North, starting at the centre stake, for a distance of 10 metres and drives in a wood preserved 1" X 2" X 18" stake. The plot then runs for a length of 5 m toward the centre stake at a width of 1 m on either side of the magnetic North line. In this plot, data is collected and recorded on woody ground cover species by density and height.

2.9 DEAD STANDING SAPLINGS

Dead saplings are connected to stump, standing upright at $\geq$45 degree angle, and having a 3.1 - 9.0 cm DBH. Within the 10 m^2 vegetation plot, the "sapling" size trees are recorded by height and density within each fire hazard class. The cycle is repeated until all fire hazard classes present are recorded.

2.10 DEAD STANDING WOODY VEGETATION

Dead, woody vegetation is connected to stump and standing upright at ≥45 degree angle, with < 3.1 cm DBH. All dead, woody vegetation within the 10 m^2 plot are recorded by height and density within every fire hazard class.

2.11 DOWN COARSE WOODY DEBRIS

This procedure records information on down, dead, coarse woody debris ≥ 9.1 cm located in the plot. It also includes trees detached from their stump and standing at any angle (over the line) as well as dead trees standing at ≤ 45° (over the line). The first effort is to establish a line transect. Start at the 2" X 2" X 18" stake used for the 10 m^2 vegetation subplot and run a line 18 m @ 210° then 18 m @ 90°, the 18 m @ 330° back to the starting point. The cruiser will now record the coarse woody debris by species, diameter and decay class on each of the three line transects.

Chapter 3: MEASUREMENT SPECIFICATIONS

3.1 INTRODUCTION

This chapter describes the measurement specifications for the data collected from the Forest Inventory Plots. Within each subject area, the specification follow the same order as information that is entered into the portable data recorder (PDR). All data should be entered into the portable data recorder at the earliest possible time.

3.2 PDR SELECTION OF PLOT

Plot: Enter the plot number you are going to establish/re-measure.

The PDR screen will provide you with information on the plot, county, region, and owner. If you do not agree with any of this data, note it on a tally sheet and advise your supervisor.

Date: month/ day/ year;

County: Confirm the county you are in. Designate by code according to the following:

Code	County	Code	County
J	Annapolis	F	Hants
B	Antigonish	S	Inverness
V	Cape Breton	K	Kings
E	Colchester	M	Lunenburg
D	Cumberland	A	Pictou
N	Digby	L	Queens
C	Guysborough East	U	Richmond
W	Guysborough St. Mary's	R	Shelburne
G	Halifax East	T	Victoria
H	Halifax West	P	Yarmouth

Region: Confirm the appropriate administrative/geographic region with the codes:

Code	Description	Counties
EAST	Eastern	Inverness, Victoria, Richmond, Cape Breton, Antigonish, Guysborough
CENT	Central	Pictou, Cumberland, Colchester, Halifax, Hants
WEST	Western	Kings, Annapolis, Digby, Yarmouth, Shelburne, Queens, Lunenburg

Ownership: A display of the ownership class of landowners which comes from the GIS system. If the cruiser has evidence that the code is not correct, a correction can be made with the following:

Code	Description	Code	Description
150	Federal	156	Small Private (Managed)
151	Crown	157	Other (Small Private)
153	Native Lands	158	DND
154	Large Private	159	Federal Parks
155	Industrial Managed	162	Leased Crown

Plot Bias: If the cruiser feels that the plot has been biassed for some reason, and no longer represents the surrounding forest, then this should be noted on the Sapling tally sheet and brought to the Supervisors attention. All measurements will be carried out as usual. The Supervisor will review the plot and conditions and report with a recommendation to keep or drop the plot.

Clear Cut: ATTENTION! This is only to be used when the plot has been clearcut and the cruiser wishes all information on merchantable trees in the plot to be cleared. In this case, enter "Y" for yes. Otherwise, the default is "N" for no, and all trees will be maintained in the plot. This would not be used for new plots in which no tree data has been collected.

3.3 MEASUREMENT OF STANDING LIVE TREES IN FIP

Tree Number: Enter the number of the merchantable tree to be measured.

Species: All standing live or dead trees ≥9.1 cm DBH will be defined by their appropriate species

code. **Only** use the code "other softwood" and "other hardwood" for unidentifiable **DEAD** trees. For a list including Latin names, see Appendix I.

SOFTWOOD

PA	Austrian Pine
BF	Balsam Fir
BS	Black Spruce
DF	Douglas Fir
EC	Eastern Cedar
EH	Eastern Hemlock
EL	European Larch
JP	Jack Pine
NS	Norway Spruce
OS	Other Softwood (Dead Only)
RP	Red Pine
RS	Red Spruce
SP	Scots Pine
SS	Sitka Spruce
TL	Tamarack
WL	Western Larch
WS	White Spruce
WP	White Pine

HARDWOOD

WE	American Elm
AL	Alder (speckled)
AP	Apple
BP	Balsam Poplar
BW	Basswood
BE	Beech
BA	Black Ash
BC	Black Cherry
CC	Choke Cherry
GB	Grey Birch
IW	Ironwood
LA	Large Tooth Aspen
MA	Mountain Ash
MM	Mountain Maple
OH	Other Hardwood (Dead Only)
PC	Pin Cherry
RO	Red Oak
RM	Red Maple
SB	Serviceberry
SH	Staghorn Sumac
ST	Striped Maple
SM	Sugar Maple
TA	Trembling Aspen
WA	White Ash
WB	White Birch
WI	Willow
YB	Yellow Birch

WOODY SHRUBS

BY	Bayberry
BL	Blackberry
BB	Blueberry
CB	Choke Berry
CU	Currants
DW	Dogwood (Red Osier)
DA	Dogwood (Alternate Leaved)
DR	Dogwood (Round-leaved)
EB	Elder (Common)
ER	Elder (Red-berried)
GH	Ground Hemlock
HT	Hawthorns
HN	Hazelnut Beaked
HC	Highbush Cranberry
HO	Hobble Bush
CH	Holly (Canada, Winterberry)
HF	Holly (False)
HS	Honeysuckle (Fly)
HB	Huckleberry
JU	Juniper (Ground and Creeping)
LT	Labrador Tea
LK	Lambkill
LL	Leatherleaf
OW	Other Woody Shrubs
RB	Raspberry
RH	Rhodora
RW	Roses
SF	Sweet Fern
WH	Witch Hazel
WR	Witherod (Wild Raison)

3.4 TREE DEFINITION AND DIAMETER

Diameter at Breast Height (DBH)

DBH is measured to the nearest millimetre using a diameter tape. On normal trees, the diameter is measured at 1.3 metres from the ground using an average ground height (See Figure 1).

Measuring DBH on abnormal trees and situations is described as follows:

- **Tree on Slope:** For trees on slopes, breast height is considered to be 1.3 m above ground on the uphill side of the tree. (See Figure 2)

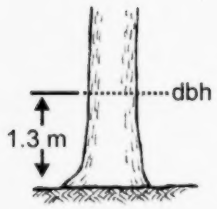


FIGURE 1. TREE ON LEVEL GROUND.

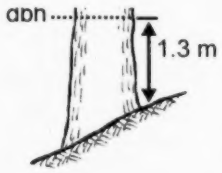


FIGURE 2. TREE ON SLOPE.

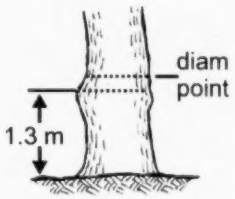


FIGURE 3. TREE DEFORMED AT BREAST HEIGHT.

- **Deformed Trees at Breast Height:** When trees have deformities at breast height, diameters should be taken just above the irregularity, at the point where it ceases to affect normal stem form. In bottleneck trees, breast height is considered to be above the swell. (See Figure 3)

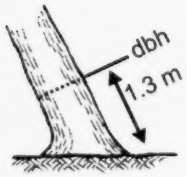


FIGURE 4. LEANING TREE.

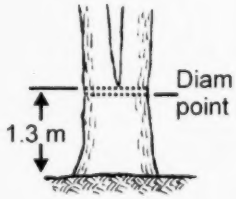


FIGURE 5. TREE FORKING AT OR ABOVE BREAST HEIGHT.

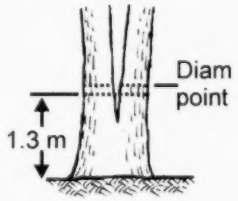


FIGURE 6. TREE FORKING BELOW BREAST HEIGHT.

- **Leaning Tree**

: With leaning trees, breast height is considered to be 1.3 m away from the ground (parallel to the tree axis) on the upward side of the tree opposite the lean. Diameter measurements should be taken perpendicular to the tree axis and not parallel to the ground. (See Figure 4)

- **Tree Fork at/or Above 1.3 m:** Trees that fork at/or above breast height are considered to be one tree and should be measured right below the swell resulting from the double stem. (See Figure 5)

- **Tree Fork Below 1.3 m:** Trees that fork below 1.3 m are considered to be two trees. Diameters are to be measured at as close to 1.3 m as possible. (See Figure 6)

Tree Status: A status must be assigned for every tree measured and those to be re-measured according to the following:

Code	Status	Code	Status
1	Live	4	Cut
2	Dead (standing)	5	Dead (down)
3	Ingrowth		

Quadrant Location: After plot establishment, the cruiser will hang a piece of flagging tape at each of the four magnetic cardinal points. Using these tapes as a guide, each recorded standing live or dead tree ≥9.1 cm DBH will be defined as being in 1 of 4 quadrants as follows:

Code	Quadrant	Code	Quadrant
1	NE	3	SW
2	SE	4	NW

Damage Agent. For each tree, the cruiser should record all significant damages noted. If the cruiser is unsure of the codes entered for a tree, then enter "ZZ" into the damage screen and the PDR will list those already used.

Code	Description
BT	Broken Top: Where the broken top exceeds 0.5 m it should be noted.
DI	Disease
DT	Dead Top: Where the top has died back greater than 0.5 m it should be noted.
FR	Frost: Generally noted on younger trees, where new-flushed needles are brown, limp and damage noted on ≥ 50% of the tree.
IB	Insect Boring: Note the presence of boring insects on tree. If boring insect other than spruce bark beetle, please note it on your tally sheet.

IS Ice or snow damage.

NL New Leader. A tree that has lost it's original leader/top and has since developed a new leader with is used to determine the tree height.

SI Sirococcus: Affects only red pine and primarily in plantations. Infection starts usually at lower live limbs and is characterized by dead needles at the end of the lateral branches. Disease is usually fatal, sweeping up the tree and resulting in death several years later (see Insect Focus).

WT Wind throw. Trees that have been tipped over by the wind and have roots lifted from where they were intially located.

WW White Pine Weevil damage

The following damage codes provide 3 levels of infestation for each insect. A manual to aid identification of common insects will be given to each cruiser. It is comprised of Insect Focus articles from the NSDNR publication Insectary Notes. If serious infestation is noted, the supervisor must pass this information on to the Forest Protection Section at Shubenacadie.

Code	Description
B1	Spruce Budworm 0-33%
B2	Spruce Budworm 34-66%
B3	Spruce Budworm 67-100%
G1	Gypsy Moth 0-33%
G2	Gypsy Moth 34-66%
G3	Gypsy Moth 67-100%
H1	Hemlock Looper 0-33%
H2	Hemlock Looper 34-66%
H3	Hemlock Looper 67-100%
M1	Tussock Moth 0-33%
M2	Tussock Moth 34-66%
M3	Tussock Moth 67-100%
S1	Sawflies 0-33%
S2	Sawflies 34-66%
S3	Sawflies 67-100%
T1	Forest Tent Cat. 0-33%
T2	Forest Tent Cat. 34-66%
T3	Forest Tent Cat. 67-100%

These last damage codes should only be recorded when they occur on the merchantable bole.

BI Bird (Feed Holes): Unhealed wounds left from bird feeding that may affect log quality on the merchantable part of the bole. It may also be possible to use these as an opportunity to check for rot.

BU Burl: A burl is a sound, hard, woody protrusion on the bole. Note their presence on merchantable wood only.

EC Excessive Crook: Where an abrupt deflection in 2.4 m section exceeds 14 cm.

EB Excessive Lean: Where bole lean exceeds 22.5°.

EL Excessive Limbs: DBH obscured or $\geq$ 50% of surface area in crown is limb base. Often found on open grown wolf trees.

ES Excessive Sweep: a constant deflection, defined as $\geq$ 14 cm in 2.4 m.

ME Mechanical (Scraping): A scar or open wound that came from rubbing or scraping

action, which may introduce rot directly into the merchantable bole. Could be made by two trees or branches rubbing on the bole or by man or machine, etc.

MT Multiple Top: To be recorded if a softwood tree contains more than one top with merchantable wood. Do not record if tree is a hardwood.

PP Porcupine: To be recorded when significant porcupine damage is found on the merchantable bole, to the extent that it may impact log volume or quality.

RT Rot Present: To be recorded when signs of rot are found on the merchantable bole, to the extent that it may impact log volume or quality.

SM Spiral Seam (that extends over more than one face) or Spiral or straight seam with rot. If seam with rot, cruiser does not have to enter a damage code of rot.

ND No Damage

ZZ (for PDR) List Damages entered for tree

XX (for PDR) Exit

3.5 SOFTWOOD PRODUCT CODE FOR LIVING TREES

Softwood trees must be 15.1 cm DBH before they can be assigned a log grade. Before assigning a grade, the cruiser should consider the following points and apply them to any logs considered.

Minimum Log Length: 2.5 m (8' 4") (includes trim)

Sweep: Before a sweep becomes a scalable defect there must be 5 cm deflection in 5 m (2" in 16'). Logs with sweep greater than this will not be classified as S1.

Knot size: Consider the diameter of the branch 10 cm away from the bole.

Small ≤ 2 cm (¾") Medium >2 to 4 cm (¾" to 1½") Large > 4 cm (1½").

Portion of Bole to Consider: To be classified as a sawlog, the cruiser should assess that over 50% of the tree's merchantable volume will be suitable for an S3 or better sawlog(s). When the cruiser applies a sawlog quality class, it should apply to the sawlog portion of the bole. To determine the presence of rot, a few trees could be drilled with the increment bore. This is strongly recommended on plots containing older (40+ year) balsam fir.

S1: The sawlog quality is better than average and would be the top ⅓ log quality of the species being considered. This material could possibly be used for specialty products, (e.g. moldings, clapboards, furniture etc.)

Defects: **Rot:** preferably none, if minimal, it could be easily cut out of the log during harvesting (e.g. old porcupine chew)
Sweep: Minimal, the larger the diameter, the less effect it may have. Remember to consider the sweep only within each individual sawlog, not the entire merchantable-sawlog bole length.
Knot Size; small diameter
Frequency; few and scattered

Health: Good. Minimal defoliation permitted and no disease present.

S2: If there could be an average sawlog in the province, this grade would cover it. It should represent the middle ⅓ of the species under consideration.

Defects **Rot**: minimal, it could be easily cut out of the log during harvesting or could be effectively slabbed out during manufacture.
Sweep: Minimal, it could be taken out during bucking or slabbed out without too much waste.
Knot Size; medium diameter (average for species)
Frequency; moderate (average for species)

Health: Good. Moderate defoliation OK, if cruiser expects tree to survive. No disease present.

S3 Sawlog of grade 3 is of the lowest quality due to numerous defects. It should represent the bottom ⅓ of the species under consideration. The lowest end of grade 3 merges with the roundwood product. It is understood that product definition is market driven and all "Sawlog" trees may be used for other purposes.

Defects **Rot**: minimal, it could be easily cut out of the log during harvesting or rot could be effectively slabbed out during manufacture. Small center rot permissible in a large diameter tree. Stain in sound wood is permitted.
Sweep: Moderate, the larger the diameter, the less effect it may have.
Knot Size; medium diameter, scattered large (> 4 cm)
Frequency; moderate to heavy (for species). Large knots must be well scattered, if they appear in clusters, then they would have to be bucked out of any potential sawlogs.

Health: Moderate, cruiser expects tree to survive at least 5 years.

Form: Forked trees which can be cleaned up to make logs would be placed in this group.

Sawlog Quality decision table based upon field variables.			
Variable	**Sawlog Quality**		
Descriptor	**S1**	**S2**	**S3**
Rot	Minimal	Minimal	Moderate
Sweep	Minimal	Minimal	Moderate
Knot Size	Small	Medium	Scattered Large
Knot Frequency	Scattered	Moderate	Moderate to Heavy
Health	Good	Good	Moderate
Defoliation	Minimal	Moderate	Moderate
Disease	No	No	Yes
Form	Good	Good	Forked Trees

RW = Roundwood: trees which would not make sawlogs, but not poor enough to be called cull wood.

CW = Cull wood: trees $\geq$ 9.1 cm, containing more than 75% rot by volume are included in cull tree classification and/or trees of such poor form that they could not reasonably be used for anything but chips.

3.6 HARDWOOD PRODUCT CODES FOR LIVING TREES

If DBH < 25.4:

RW = Roundwood: all hardwood trees better quality than cull wood, and including potential sawlog material that is not yet of sufficient diameter to be graded as a log.

CW = Cullwood (non-merchantable but living): trees $\geq$ 9.1 cm, containing more than 75% rot by volume are included in cull tree classification and/or trees of such poor form that they could not reasonably be used for anything else except chips.

If DBH > 25.4 cm:

RW = Roundwood: all hardwood trees better quality than cull wood

CW = Cullwood (non-merchantable but living): trees $\geq$ 9.1 cm, containing more than 75% rot by volume are included in cull tree classification and/or trees of such poor form that they could not reasonably be used for anything else except chips.

SL = Sawlog (the following information is required for hardwood sawlogs): Each hardwood over 25.4 cm DBH has the potential to be a sawlog and should be evaluated by the cruiser. If the cruiser has any doubt that the hardwood tree may be of log quality, the cruiser should

collect the relevant data to ensure **all** sawlogs are graded. Since hardwood grading is based on imperial measurements, all field measurements will also be in imperial.

3.7 HARDWOOD SAWLOG DATA FOR GRADING:

Stump Height (in): Measure from average ground height up to the point where the tree would be harvested.

Top Diameter at 12': Cruiser to estimate the inside bark bole diameter in inches of the tree at 12' above stump height.

Top Diameter at 16': Cruiser to estimate the inside bark bole diameter in inches of the tree at 16' above stump height.

Merchantable Sawlog Length (ft): Cruiser to estimate the total length of bole above stump height which may qualify as a sawlog. This will give us a general picture of sawlog length in the province. If the bole quality is good, with no significant defects, then the length would continue from stump height up until the bole reaches the minimum log diameter of 8".

Diameter at Top of Merchantable Length: Cruiser to estimate the inside bark bole diameter in inches of the tree at the top of the highest log.

Sweep: If the log is a single or multiple sweep, the cruiser should measure the length and deflection. This is done with three measurements. For simplicity, if more than one sweep is encountered, the cruiser should combine the information. Sweep must be entered with a minimum length of 8'. Shorter sweeps should be recorded as crook.

Stump to start of Sweep: Measure this and record it to the nearest full foot.

Length from Stump to stop of Sweep: Measure this to the nearest full foot (if there are 2 sweeps involved, measure from the stump to the end of the second sweep).

Deflection: Measure and enter to the nearest full inch (If there are 2 sweeps, then add the deflection of each sweep together).

Crook: If the log has a crook, then the following measurements are recorded.

Length from Stump to start of Crook: Measure and record to the nearest full foot.

Deflection: Measure and record to the nearest full inch at the point where the crook has the maximum deflection.

Straight seam with rot: If the log has a straight seam with rot, then the following measurements

are recorded.

Length from stump to start of seam: Measure and record to the nearest full foot.

Length from stump to stop of seam: Measure and record to the nearest full foot.

Width of seam: Measure and enter to the nearest full inch.

Scalable Defects: The cruiser must now evaluate the full 16' bole (or to top of log, if shorter) and record all scalable defects. Refer to NSDNR internal Forest Inventory Hardwood Scaling Manual (ed. Charles Harrington) for additional information and pictures of common defects, fungus and conks.

Type of Scalable Defect: Enter scale defect using the following codes.

Code	Defect
10	**Butt Bulge**: Nearly always accompanied by hollow butt. Rot generally extends beyond the hollow and the upper tapered-off limit of the bulge usually indicates the approximate upper limit of serious rot. Butt bulge has no special relation to species, although it is most frequently conspicuous in the oaks. In species like elms and ashes, even considerable butt rot may not cause a clearly defined butt bulge. In these species the bark over even a slight bulge often becomes smoother and darker and scales off faster than in a sound stem.
11	**Butt Scar with Rot**: A butt scar is generally a triangular or wigwam-shaped opening at the base of the bole, from a few inches to several feet high. It may show weathered or stained sapwood, rotten heartwood, or may be the opening into a rotten hollow butt. When associated with advanced rot or hollow, it may be accompanied by a butt bulge. It is caused by anything that "skins" the base of the tree. Fire is the most common cause, other causes are logging and cattle.
12	**Canker with Rot**: A canker is a definite, relatively localized necrotic lesion, primarily of bark and cambium. Surface degradation must be more that 2" in depth and rot indicators such as conks or fungus are usually present.
13	**Hole:** Holes can be found on all species. They are unoccluded 3/16" and larger openings through the bark which may or may not continue into the wood. They include entrance and emergence holes of grubs, taps, increment borers and sapsuckers.
14	**Unsound Knot**: Knots are broken-off limbs or branches, green or dead, protruding,

flush, or depressed, but with exposed sound or rotten wood. If the exposed wood is rotten, it is "unsound".

15 **Stem Bulge**: Not as common as butt bulge, but may be found in any species. Rot generally extends beyond the hollow and the upper, tapered-off limit of the bulge usually indicates the approximate upper limit of serious rot. In some species the bark over even a slight bulge often becomes smoother and darker and scales off faster than in a sound stem.

16 **Scars and Wound w/Rot**: Wounds are openings in the bark that expose sapwood and sometimes heartwood. Wounds may be either new or old. A new wound is essentially a surface injury in which the exposed adjacent sapwood is apparently sound. An old wound is a similar injury either completely open or only partially healed over. It is generally recognized by unsound sapwood, local hollow, much callus tissue, insect damage and often stained or actually rotten heartwood. In a new wound deterioration is usually not serious, for any insect damage or stain will be quite superficial. Therefore, under most conditions, new wounds can be disregarded as defects. The seriousness of an old wound varies considerably with locality and with species. In some species exposed heartwood may completely heal over before serious injury occurs. Nevertheless, since old wounds are usually associated with stain, rot and insect damage, the affected area is a grading defect, except in the rare cases where it is superficial.

17 **Straight Seam, No Rot**: Seam should exceed 2" in depth, disregard shallow seams. It should be possible to saw the log so that it is not on a face and have minimal impact.

18 **Spiral Seam, No Rot**: A seam or crack exceeding 2" in depth and which spirals around the bole to the point where it may affect 1/2 of a face or greater.

19 **Spiral Seam w/Rot**: Spiral seam has evidence of rot present.

20 **False Tinder Fungus**: On hard maple the false tinder fungus fruit body is hoof-shaped, perennial. Upper surface is grey/black, roughened with age, with a sterile whitish outer rim; lower surface rust-coloured, with small, round pores. Interior shows several layers of tubes, often filled with white mycelium. On beech, the fruit body also may be shelf or bracket-shaped. On yellow birch, the conk is more flattened against the trunk.

21 **Mossy-Top Fungus**: Found on hard maple. Mossy-top fungus conks are perennial, white, soft, spongy and appear water-soaked, usually with green moss or algae on upper surface. Lower surface is white with small pores. Conks frequently occur on lower butt, often clustered in layers.

22 **Spine-Tooth Fungus**: Found on hard maple. Spine-tooth fungus fruit bodies are annual, large, soft, soggy conks occurring in bracket-like clusters on trucks. The undersurface has slender spines or teeth rather than pores. Conks form in late summer and are destroyed by frost. White patches on trunk indicate location of previous fruit bodies.

23 **Coal Fungus**: Found on hard maple. Coal fungus fruits on the butts of infected trees, often inconspicuously at a seam or scar. Fungus is an Ascomycete and does not produce a bracket conk. Fruit body is a thin, crust-like, black carbonaceous stroma, appressed on the trunk surface. Advanced decay is a brittle white rot containing numerous prominent black zone line.

24 **Punk Knot**: Found on hard maple. Canker rot or punk knot is recognized by the sterile, black, cinder-like plugs that form at old branch stubs, which often become swollen by callus growth. Also on beech. Sterile conk is protruding from a branch stub. They are usually more obvious on beech than maple. Advanced decay is a yellow-brown stringy trunk rot. The fungus may cause long, depressed cankers on both hard maple and beech in which black stroma eventually erupts through the bark. The fungus fruits only on down, dead stems.

25 **Cinder Conk**: Found on yellow birch. Cinder conk or clinker fungus forms large, sterile plugs, that are initially yellow but become black, rough, hard and cinder-like and may form a canker. The fungus causes a yellow-brown stringy trunk rot. In another type, fruit bodies are thin, crust-like, often cracked, with an olive-buff colour. They occur only on dead portions of the tree, often associated with cankers. Decay is a yellow-brown stringy trunk rot.

26 **Artist's Conk**: Found on hard maple. Artist's conk is perennial and shelf-like, with a grey, smooth upper surface marked with concentric ridges. The undersurface is white and chalky, turning brown when touched. Interior has several strata of brown tubes (chocolate layer cake). Fungus causes a white mottled rot, usually on dying trees (scavenger rot).

27 **Sulphur Fungus**: Found on hard maple. Sulphur fungus has annual, soft, fleshy moist conks that occur in overlapping clusters. Upper surface is orange-red, brighter at the margins; lower surface is red-yellow. Advanced decay is a brown cubical rot.

28 **Tinder Fungus**: Found on yellow birch. Tinder fungus conks are perennial and hoof-shaped, with a grey concentrically-zoned upper surface frequently extended as a sterile rim. Lower surface is grey-brown, with large pores. Interior is fibrous/punky. Common white spongy scavenger sap rot of dying trees.

Length from stump to start: Measure and record to the nearest full foot.

Length from stump to stop: Measure and record to the next nearest full foot.

Grade Face Mark: At this point the cruiser will now look at the tree, ocularly dividing it into 4 faces. Following a close review of each face, the scaler will choose the second worst face (the third best) and identify this grading face on the tree with a large painted ✚ symbol located below breast height.

Grade Defects on Grading Face: The cruiser will now record all grade defects found on the grading face. Refer to NSDNR Hardwood Scaling Manual for pictures of most defects.

Type of Grade Defect: Enter grade defect using the following codes.

Code	Defect
10	**Bark Distortion**: Pronounced breaks across the bark. Only record medium to heavy bark distortions.
11	**Bird Pecks (old)**: Old pecks filled with callus at a density of more than 4 pecks per square foot.
12	**High Bump**: A bump with a Height to Length ratio of 1:3 or greater.
13	**Medium Bump**: A bump with a Height to Length ratio of 1:6 to 1:3.
14	**Low Bump**: A bump with a Height to Length ratio of 1:12 to 1:6. A low bump is not considered a defect in red maple, birch or elm.

15 **Butt Bulge**: Pronounced butt bulges and swells.

16 **Butt Scar**: A scar or wounds that are openings in the bark that expose sapwood and sometimes heartwood. Disregard new wounds. However, the seriousness of an old wound varies considerably with locality and with species. In some species exposed heartwood may completely heal over before serious injury occurs. Nevertheless, since old wounds are usually associated with stain, rot and insect damage, the affected area is a grading defect, except in the rare cases where it is superficial.

17 **Burl**: A burl is a sound, hard, woody protrusion on the bole, or less rounded or horizontally ridged in form, with no protruding limbs, twigs, stubs, or indications thereof. It is sometimes related to aborted adventitious buds. Burls, while uncommon, are most often found on hard maple, northern red oak and yellow birch.

18 **Canker**: A canker is a definite, relatively localized necrotic lesion, primarily of bark and cambium. It is usually an entrance for decay fungi and, when conks are present, is evidence of serious heart rot. It is most common on oak, the ashes and black cherry.

19 **Conk**: A conk is a fibrous but sometimes fleshy excrescence of definite form and structure on the bole. It is the fruiting body of a wood-rotting fungus contained in the tree. Conks may occur on all species.

20 **Corky Bark**: Corky bark is a swelling of the tree stem covered with coarse, rough bark. The cause of this condition is unknown. Corky bark can be found in most species, but it is most common in yellow birch.

21 **Adventitious Twig**: Epicormic buds are abnormal buds found at points on the stem unrelated to the crown. They arise from latent or dormant buds originating in the leaf axil and thus may persist within the cortical-cambial zone indefinitely and can be activated at any time in response to various stimuli. Adventitious bud clusters, similar but independent in origin, may arise at any time during the life of the tree. They often originate in the callus tissue resulting from wounding or bruising the cambium layer, but may develop independent of any such mechanical action. Very often, they develop into clusters of fine twigs of short life, and in this case they are commonly accompanied by small bark pockets. They are not necessarily repetitious and are less common on most species than epicormic branches. They are found most frequently on all species of elm, oak and maple.

22 **Flutes**: Flutes are folds or convolutions of the surface of the truck running up and down and generally confined to the base, but occasionally extending up into the second log. They generally include in-grown bark. They appear to be of normal origin, related to softness of site, much as flanges are. They are commonly found in soft maple, sugar maple and elm. The most exaggerated flutes are found in the elms.

23 **Fork**: A division in the merchantable bole of the tree which sees the bole go from one merchantable stem to two merchantable stems. Most common on open grown trees.

24 **Galls**: An abnormal outgrowth in plant tissue caused by certain parasitic insects, fungi or bacteria. Often contain small knots and bark.

25 **Holes**: Holes can be found on all species. They are unoccluded 3/16" and larger openings in the bark which may or may not continue into the wood. They include entrance and emergence holes of grubs, taps, increment borers and sapsuckers.

26 **Knots**: Knots are broken-off limbs or branches, green or dead, protruding, flush, or depressed, but with exposed sound or rotten wood. If the exposed wood is rotten, it is unsound.

27 **Limbs**: All tree branches except a fork.

28 **Overgrowths**: Includes overgrowths of knots, bird pecks, insect damage, etc.

29 **Seams**: Cracks exceeding 2" in depth.

30 **Stem Bulge**: A pronounced swelling located above the stump level.

31 **Stem Lesion**: A scar left typically from squirrel damage that heals to form a slit-like scar usually 2 to 4" in length.

32 **Worm Holes**: Holes left from the infestation of worms/borers.

33 **Wounds**: Wounds to the bole which are usually more round and often larger than a lesion.

Length from stump to start of defect: Measure and record to the nearest 1/10 of a foot.
Length from stump to stop of defect: Measure and record to the nearest 1/10 of a foot.

Tag: The cruiser is asked the question, is tree tagged? The PDR maintains a list of all trees that are not tagged. This will help the cruiser at the end of the plot measurements when it is time to put tags on all untagged trees.

3.8 TREE HEIGHT MEASUREMENTS

Total Tree Height: Live trees are measured to the top of their live crown to within 0.1 m. If tops are broken or dead, ensure that this is recorded in the damage codes, and measure to the top of the live crown. Whatever the equipment used to measure the tree height, the cruiser should attempt to be at least the height of the tree away from the tree when measuring.

Length of bole to base of live crown: The cruiser will measure and record the length from average ground level to the base of the live crown in metres (to within 0.1 m). The base of the live crown is the point on the bole where the cruiser interprets that 3 of the 4 quadrants of a tree crown contain live foliage (not just branches). In some trees, like those at the edge of an opening, this will require the good judgement of the cruiser, as it requires experience to define properly and consistently.

Health of tree: Cruiser should evaluate all relevant variables to determine tree health. The following code descriptions are guidelines, but the cruiser's sound judgement is beneficial in proper evaluation.

Code	Description	
1	Good	The tree should have a live crown length $\geq$ 33% of tree height with healthy foliage and no signs of rot in the bole.
2	Moderate	The tree should have a crown length < 33 % of tree height and healthy foliage, or have a crown length $\geq$ 33 % but contain either moderate defoliation, signs of rot, or a broken top.
3	Poor	The tree should have a crown length < 33% of tree height and also suffer from unhealthy or partially to totally defoliated foliage. Or the tree should have a crown length $\geq$ 33 % but severe defoliation or moderate to severe signs of bole rot.

Crown Class Code: Enter cruiser estimated crown dominance class according to the following.

Code	Class
0	Broken or Dead Top

1	Dominant	Trees with crowns extending above the general level of the crown cover, receiving full light from above and partly from the side; larger than average trees in the stand and with crowns well developed but possibly somewhat crowded on the sides.
2	Co-dominant	Trees with crowns forming the general level of the crown cover and receiving full light from above but comparatively little from the sides; usually with medium sized crowns more or less crowded on the sides.
3	Intermediate	Trees shorter than those in the preceding classes but cover formed by co-dominant and dominant trees; receiving little direct light from above and none from the sides; usually with small crowns considered crowded on the sides.
4	Suppressed	Trees with crowns entirely below the general level of the crown cover and receiving no direct light either from above or from the sides.
5	Wolf Tree	Large, often many limbs or poor quality residual trees from an earlier canopy. They should be 5 m greater than the present height of dominant trees or be 30 cm greater DBH than the present dominant trees.
6	Cut	Tree harvested or manually/mechanically severed from stump.
7	Dead	Tree not living.

3.9 DEAD STANDING TREE MEASUREMENTS

All dead trees standing between 45° and 90° angle and $\geq$ 9.1 cm DBH, and attached to the stump, will be numbered as described earlier and measurements taken of the following. If the cruiser has entered a tree status of 2 (dead standing) then the following information is required. Dead trees $\geq$ 9.1 cm DBH and not attached to the stump, or all trees attached to the stump, but leaning $\geq$ 45° should be measured as coarse woody debris.

Tree Number: Use the same sequence as with living trees.

Species Code: Use the same codes as with living trees, except that 2 extra codes are available for trees which cannot be identified: OS = Other Softwood OH = Other Hardwood

DBH: Use the same procedure as with living trees.

Status: Use the same codes as with living trees.

Quadrant Location: Use the same procedure as with living trees.

Top Diameter: Cruiser to estimate the diameter at the top of the tree and record in centimetres. If tree has an unbroken top, record 1, otherwise, record cruiser's estimate. It is forecast that an experienced cruiser can estimate top diameter to within 2 cm of actual.

Decay Class: The cruiser is to ocularly scan the dead tree and assign a decay code as follows.

Code	Description
1	Recently dead, branches and twigs intact, bark on, no decay resulting from mortality.
2	Dead for a number of years, shedding fine twigs and branches, bark loose and flaking, fairly sound/windfirm bole has signs of decay/rot in sapwood or heartwood that was sound at time of mortality.
3	Advanced decay/rot in bole, most of bark flaking off or absent, stability declining.

Carpenter Ants: The cruiser should check for tell-tale sawdust or the presence of ants and report on the presence of ants with a "yes" or "no". This is most relevant in recently deceased trees.

Cause of Death: The cruiser is asked to determine the cause of death for each dead tree. While it is recognized that this is often impossible to determine, the cruiser should use his experience to help render the best possible estimate whenever possible. It is better to give the best knowledgeable estimate, then to record "Unknown". Hopefully, in 5 years, after all old (> 5 yrs) dead trees are assessed, this exercise will have fewer "Unknown" recorded.

Code	Description	
10	Unknown	Cruiser has no evidence of why the tree died.
11	Wind throw	Tree uprooted.
12	Wind breakage	Tree broken off.
13	Insect	Recent infestations in this local area combined with an

		apparently healthy tree suggest that the insects may have caused its death.
14	Disease	Recent infections in this local area combined with an apparently healthy tree suggest that the disease may have caused its death (eg. root rot, sirococcus).
15	Animal	Evidence of severe porcupine damage. Put humans here as well (eg. vandal campers, logging damage, etc. and note on tally sheet).
16	Fire	Evidence of charring or heat damage.

Leaning: If freshly killed trees are leaning, it has been observed that this is a favourite site for the spruce bark beetle. It is requested that the cruiser indicate the amount of lean from horizontal ground level to bole of tree. An upright tree without lean would be entered as 90°.

Tree Height: Measure and record height to within 0.1 m to the top of the tree.

3.10 SAPLING DATA

All live saplings in the 4, 6, and 8 cm DBH classes will be counted by species (both commercial and non-commercial tree and woody plants as per Appendix I). Each tree is dot tallied on a tally sheet as the cruiser identifies it by species and diameter class. The diameter class is determined by using a diameter tape at breast height. A 4 cm class sapling would have a diameter measured at breast height in the range of 3.1-5.0 cm, 6 is 5.1-7.0 and 8 is 7.1-9.0. Following the measurement and recording of all saplings by density, the cruiser must sample measure and assign an average height to each species/diameter class combination. This height is expected to be within 0.5 metres and recorded to the nearest 1/10 of a metre (0.1m). The following represents a tally sheet similar to that used in the field (for field tally sheet, see Appendix II).

Sapling Diameter at Breast Height		Species (all woody vegetation)			
DBH Class (cm)	DBH Range (cm)	Species (example -bF)	Height (m)	Species	Height (m)
4	3.1 - 5.0	::	4.1		
5	5.1 - 7.0	"	5.5		
6	7.1 - 9.0	.	8.3		

3.11 PLOT DATA

General: The data relative to the plot will be confirmed by the cruiser where possible and recorded or corrected using the following codes.

Type of Cut: If any trees have been cut within the last 9 years, record this using the following codes. If harvested two times, record only the most recent.

Code	Description
0	No cutting within last 9 years.
1	Clear cut: A harvest that leaves < 25% of the previous crown closure on the site.
2	Partial cut: A harvest that leaves ≥ 25% of the previous crown closure on the site.

Land Capability: Three trees will be chosen and measured for land capability by following the methods outlined in Chapter 2. If the tree is on the plot, then by entering the tree number, the PDR will return the species and height on the screen. The cruiser must obtain a clean countable core which hits the centre of the tree, and carefully count the rings. This is a singular effort that may not be repeated for one generation of growing stock, so the cruiser must ensure the data collected is accurate. It is recommended that the cruiser use a pen/pencil and mark every 10th ring, so that on recount, any errors can be easily found. The cruiser should do a double check of the ring count. At the cruisers discretion, it may be a good idea to have the forestry assistant do this second count. If the capability tree is off the plot, the cruiser must also record the species and measure and record the total tree height in addition to the age. As stated in Chapter 2, *Age is extremely important; if there is any difficulty in counting the rings, the increment cores should be extracted from the appropriate tree, inserted into the storage container, labelled as to plot number, tree number, and species, and returned to the office for ring counting."*

Addition, March, 2002. For re-measurement of plots that were measured between 1998 and 2002. These plots should have had LC measurements at the last measure. Generally, this will be sufficient, and LC will not have to be re-measured for some time. However, there are a few instances when a re-measurement is required.

1) where the LC was not done last time.
2) where the previous LC is less than 1 m^3/ha/yr and younger or better trees can be found.
3) when the age of the LC trees was 43 to 47 yrs last time. (This is to capture the optimum time for Site Index)
4) when the cruiser feels a new LC is required (Do Not use PDR LC entry screen, please enter new information and reason for New LC on a file amendment form)

Age: Three trees closest to the diameter of the tree of average basal area of the plot will be measured for DBH tree age and recorded. The three trees are chosen as described in the methods of Chapter 2. Similar to the capability tree age, the cruiser must obtain a clean countable core which hits the centre of the tree, and carefully count the rings. It is recommended that the cruiser use a pen/pencil and mark every 10th ring, so that on recount, any errors can be easily found. The cruiser should do a double check of the ring count. At the cruiser's discretion, it may be a good idea to have the forestry assistant do this second count. If in doubt, bring the cores back to an office for ring counting.

The portable data recorder will list the 6 trees, in descending order, which are closest to the tree of average basal area. The cruiser will select the 3 that were aged, then enter the age of each tree as prompted.

In young and regeneration stands, the age will be determined by finding three representative saplings and counting the branch whorls to determine the age at breast height.

Addition, March, 2002. For re-measurement of plots that were measured between 1998 and 2002. These plots should have had 3 trees measured at the last measure. Generally, this will be sufficient, and age will not have to be re-measured for some time (20 years). However, there are a few instances when a re-measurement is required.

1) where the age was not done in last 15 years,
2) where there has been mortality of >10% of the stand volume. (Cruiser to use their own good judgement. Eg. 35 trees last time and 4 of the oldest and largest have died, then cruiser should take a new age, using the PDR to select the trees.)
3) where there has been a harvest of >10%1 of the stand volume.

Age of Cut: Record the number of growing seasons from when the plot was cut to the date that the plot is re-measured. The cruiser should be able to decide on the age of the cut from observations in the plot. If in doubt, the cruiser should try and contact the landowner or contractor. If the number of seasons cannot be resolved, then the cruiser should contact their supervisor for help. This is for harvests within 9 years. If no harvesting within 9 years evident, record 0. If the harvest occurred within 9 years, but before the last re-measure, then the cruiser should consult with the historical data on the re-measure tally sheets.

Aspect: From the centre stake, look around the plot and determine the direction that it is sloping. With a compass, measure and record average aspect (°) of the plot in

magnetic azimuth bearing. North will be recorded as 360° while flat will be recorded as 0°.

Slope: After locating the aspect, use an hypsometer or a relascope to measure, then record, the average slope (%) of the plot. If you cannot measure in %, then use your angle gauge to measure angle in degrees then convert to % using table provided in Appendix V.

Forest Treatment: The forest treatment designations come from the GIS system and have their origins in the original MOPS manual. If the cruiser has evidence that the treatment code is not correct, a correction can be made with the following codes.

Code	Description
00	Natural: Any forested area which has not been treated silviculturally and does not qualify under clear cut, burnt, old field or wind throw, or dead categories.
02	Artificial Regeneration: Now called "planting" and defined as the reforestation or afforestation of an area with bare root, container stock, or other manually grown forest stock.
05	Cleaning/Thinning: No longer used, it has now been combined with pre-commercial thinning.
06	Harvest: The harvest of 1 or more trees within 10 years of photo interpretation.
07	Pre-commercial Thinning: A thinning operation intended to shorten the rotation age of immature, dense, naturally regenerated stands and plantations by promoting the growth and quality of desirable crop trees.
08	Commercial Thinning: A thinning operation carried out in merchantable stands to increase yields by harvesting trees that would otherwise be lost to mortality, and promote the growth and quality of desirable crop trees.

Cruiser #: Enter the unique number assigned to the cruiser or company that completed this plot. Cruiser numbers are assigned by the supervisor.

3.12 DUFF DEPTH, SOIL DRAINAGE AND ROCK INFORMATION

Duff Depth: Identify an even, undisturbed location in each of all four quadrants and sample and record the duff depth. Using a trowel, dig a vertical hole up to a maximum depth of 30 cm. Record depth of duff in each hole to the closest centimetre. All duff thicknesses recorded as 30 cm will be interpreted as 30+ cm.The first hole should be dug in quadrant 1 and then proceed through quadrants 2, 3, and 4.

Soil Drainage: Define the soil drainage using the following descriptions and codes. If the cruiser is unsure of drainage and needs to look in the soil for clues, the trowel for the duff depth may be used to expose some soil.

Code	Description
1	Excessively Drained: Thin LFH, soil has very bright colours, no soil mottling, coarse sand texture.
2	Well Drained: Thin LFH, soil has bright colours, no soil mottling, variable texture.
3	Imperfectly Drained: Moderately deep LFH, dull soil colours, mottling "B" horizon, sphagnum moss in hollows.
4	Poorly Drained: Deep LFH, white soil colours, mottling "A" and "B" horizons, sphagnum moss common.

Surface Stoniness: Stoniness refers to the rock fragments on the surface of the soil or those protruding above ground. Rockiness refers to bedrock outcropping at the earth's surface. Assess the whole FIP for stoniness and record the results using the following codes.

Code	Description	Surface Cover (%)	Between Stones (m)
0	Non-stony	<0.01	> 25
1	Slightly Stony	0.01 - 0.10	8 - 25
2	Moderately Stony	0.1 - 3	1 - 8
3	Very Stony	3 - 15	0.5 -1
4	Exceedingly Stony	15 - 50	0.1 - 0.5
5	Excessively Stony	>50	<0.1
9	No Stones	NA	NA

Average Stone Diameter: Record the average stone diameter to nearest 0.1 m.

Bedrock/Rock Outcrops: Cruiser will estimate the percentage of the 1/10 acre plot that is comprised of exposed or thinly covered bedrock.

3.13 GROUND COVER AND VEGETATION

Ground Cover: The ground cover over the entire 1/10 acre FIP is recorded using the following categories. It is possible to have more than 100% of the space occupied, as

it may be occupied at different layers.

Description of Types of Ground Cover

Leaf Litter - Consider the site all year long, and assign a percentage based upon your experience. If it is late fall and you see 100% leaves, consider the summer as well. If you find evidence that the site contains ferns and herbs throughout the growing season, then consider reducing the amount of leaves to the area occupied by them during the growing season.

Needle Litter - See above on leave litter and treat similarly.

Slash/Woody Debris - Both coarse and fine slash and woody debris are defined. For example, if area has been harvested or suffered previous blow down damage.

Club Moss - All club mosses and running club mosses.

Other Moss - Any mosses not called a club moss.

Ferns - All ferns, be careful to look for signs during off seasons.

Herbs - All herbs, be careful to look for signs during off seasons.

Sedges & Grasses - All sedges and grasses on the plot.

Lichen - All lichens.

Bare Mineral Soil - All exposed mineral soil, which would include exposed stones. (bedrock is recorded in the duff/soil/rock menu).

Water/Snow - All ground covered with standing water or snow.

Unclassified - This category exists for the purpose of data entry when the ground cover does not fit in any of the above categories. It is considered a temporary classification, as the cruiser should report this situation to the supervisor. In addition, the cruiser should describe the content of this ground cover on the Ground Cover and Vegetation tally sheet # 3 for future reference. The new variable will then be reviewed to see whether a new category should be created.

Amount of Ground Cover: For each of the above recorded ground cover codes, there must be an associated coverage amount recorded according to the following classes.

Code	Description
1	None (0)
2	Scattered (1-10%)
3	Low (11-40%)
4	Medium (41-70%)
5	High (71-100%)

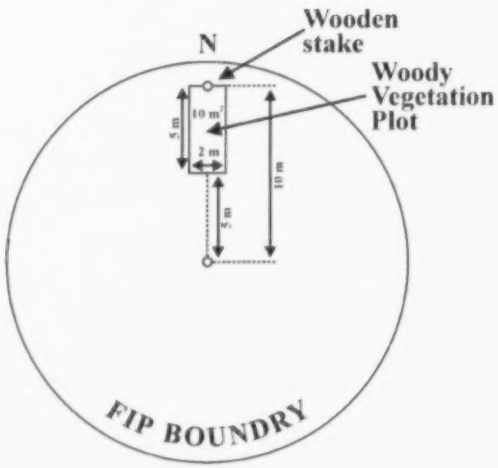
The following table exhibits a Ground Cover table as completed within tally sheet #3, similar to that used in the field.

Group	Species	Presence of Ground Cover				
		None (0) 1	Scattered (1-10%) 2	Low (11-40%) 3	Medium (41-70%) 4	High (71-100%) 5
Leaf Litter	dead leaves				4	
Needle Litter	dead needles	1				
Slash/Woody Debris	dead woody debris from harvest or blow-down					
Club Moss	all club mosses		2			
Other Moss	mosses		2			
Ferns	ferns			3		
Herbs	herbs		2			
Sedges & Grasses	sedges & grasses	1				
Lichens	lichens	1				
Bare Mineral Soil	bare mineral soil	1				
Water/Snow	water, snow	1				
Unclassified	none of the above	1				

3.14 WOODY VEGETATION IN 10 m^2 SUBPLOT

Woody Vegetation Species:

Record all living woody species ≤ 3.0 cm with appropriate code using species' list defined earlier in Chapter 3.



Density: Enter stem number of stems counted for each vegetation species. Please note that stem counts which exceed 50 may be estimated after the initial 50 stems are counted. Therefore, if a count of 50 bF are recorded, and only half the plot is tallied and the remainder of the plot appears to have the same density of bF, then the estimated count of 100 may be recorded.

Height: Enter average height for each recorded vegetation code. If there is only one specimen, do not hesitate to record the exact height to the closest cm, rounding is not necessary. It is expected that cruisers will estimate within a precision of $\pm$5 cm.

The following represents a completed tally sheet similar to that used in the field (for field tally sheet, see Appendix II).

Vegetation (Code)	Density (number of stems)	Average Height (to $\pm$ 5 cm)
BF	15	150
RS	22	120
LK	45	40
RM	1	38*
SF	4	50
Continue until all species are recorded.		
* If there is only one specimen, do not hesitate to record the exact height, rounding is not necessary.		

Reflection: The degree to which the cruiser estimates that the vegetation on this subplot reflects the vegetation species and densities found on the rest of the 1/10 acre sample plot. Record code for the appropriate degree of reflection.

Code	Description
1	Highly reflects
2	Moderately reflects
3	Low reflection

3.15 DEAD STANDING VEGETATION FOR SAPLINGS

Saplings: All dead sapling size trees (DBH 3.1 to 9.0 cm) located in the 10 m^2 vegetation subplot are recorded by fire hazard class by hardwood/softwood and needle retention

class. Saplings must be connected to stump, standing at ≥45 degree angle and 3.1 - 9.0 cm DBH.

Fire hazard class: Record applicable fire hazard class code.

Code	Description
1	Softwood with > 50% needle retention
2	Softwood with < 50% needle retention
3	Hardwood

Number of stems: Record field count from field tally sheet # 3 (Appendix II).

Average height: Record average height in metres. With experience, it is expected that the cruiser will estimate sapling height to within ± 0.5 m.

3.16 DEAD STANDING VEGETATION FOR WOODY VEGETATION

Woody Shrubs: All woody species that are dead, connected to stump, ≥45 degree angle, < 3.1 cm DBH and located in the 10 m^2 vegetation subplot are recorded by fire hazard class by hardwood/softwood and needle retention class.

Fire hazard class: Enter applicable fire hazard class.

Code	Description
1	Softwood with > 50% needle retention
2	Softwood with < 50% needle retention
3	Hardwood (presence or absence of leaves is irrelevant)

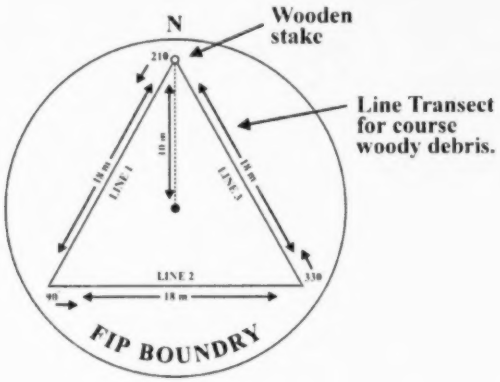
Number of stems: Record manual field count from field tally sheet # 3 (Appendix II).

Average Height: Record average height in centimetres. It is expected that the cruiser will estimate height to within ± 10 cm.

3.17 DOWN, COARSE, WOODY DEBRIS

This procedure records information on down, dead, coarse woody debris ≥ 9.1 cm located in the plot. It also includes trees detached from their stump and standing at any angle (over the line) as well as dead trees standing at ≤ 45° (over the line). The first effort is to establish a line transect. Start at the 1" X 2" X 18" stake used for the 10 m^2 vegetation subplot and run a line 18 m @ 210°

then 18 m @ 90°, then 18 m @ 330° back to the starting point (Figure 7). If the cruiser undershoots or overshoots the starting point, please ensure data recording continues to, and only to, the final 18 metre mark. The cruiser will now record the coarse woody debris in the following manner.



Line Number: Enter line number 1, 2, or 3 of the triangle.

Slope of line: Enter slope in percent (not necessary if less than 20 % (11.5°) (Slope = 100 * tan(rad(x)), where x is angle in degrees). Because of the recording of slope, the cruiser need not compensate for horizontal slope correction during measurement.

Species: Enter species code (page 3 of this document, OS and OH permitted if cruiser is unsure).

Diameter: Enter diameter to nearest 2 cm class (10, 12, 14 etc.). On angled dead trees above the ground, the cruiser should estimate the diameter of the tree bole directly above the line, perpendicular to bole.

Angle: Enter angle of deadwood from horizontal to closest degree. Not necessary if angle less than or equal to 20° (36 %).

Decay class: Enter code of decay class.

1 bark on, hard bole, round, twigs and branches present and supporting log partly off ground

2 bark flaking, mostly hard bole (little decay), round, few branch stubs, flat on ground

3 bark mostly gone, soft bole, oval, sinking into ground

The cruiser records this information on each of the 3 lines until all coarse woody debris is tallied.

APPENDIX I

Tree and Woody Shrub Latin Names 45

APPENDIX I

COMMON NAME	CODE	LATIN NAME(S)
SOFTWOODS		
Austrian Pine	PA	Pinus nigra (Arnold)
Balsam Fir	BF	Abies balsamea (L.) Mill
Black Spruce	BS	Picea mariana (Mill) B.S.P.
Douglas Fir	DF	Pseudotsuga menziesii (mirb.) Franco
Eastern Cedar	EC	Thuja occidentalis (L.) Carr
Eastern Hemlock	EH	Tsuga canadensis(L.) Carr
European Larch	EL	Larix decidua Mill.
Jack Pine	JP	Pinus banksiona Lamb.
Norway Spruce	NS	Picea abies (L.) Karst.
Other (Dead Only)	OS	
Red Pine	RP	Pinus resinosa Ait.
Red Spruce	RS	Picea rubens Sarg.
Scots Pine	SP	Pinus sylvestris L.
Sitka Spruce	SS	Picea sitchensis (Bong.)
Tamarack	TL	Larix larcina (DuRoi)
Western Larch	WL	Larix occidentalis Nutt.
White Spruce	WS	Picea glauca (Moench)Voss
White Pine	WP	Pinus strobus L.
HARDWOODS		
American Elm	WE	Ulmus americana L.
Alder (speckled)	AL	Alnus rugosa(DuRoi) Spreng.
Apple	AP	Malus sp.
Balsam Poplar	BP	Populus balsamifera L.
Basswood	BW	Tilia americana L.
Beech	BE	Fagus grandifolia Ehrh.
Black Ash	BA	Fraxinus nigra Marsh.
Black Cherry	BC	Prunus serotina Ehrh.
Choke Cherry	CC	Prunus virginiana L.
Grey Birch	GB	Betula populifolia Marsh.
Ironwood	IW	Ostrya virginiana (Mill.)K.Koch
Large Tooth Aspen	LA	Populus grandidentata Michx.
Mountain Ash	MA	Sorbus americana Marsh.
Mountain Maple	MM	Acer spicatum Lamb.
Other (Dead only)	OH	
Pin Cherry	PC	Prunus pensylvanica L.f.
Red Oak	RO	Quercus rubra L.
Red Maple	RM	Acer rubrum L.
Serviceberry	SB	Amelanchier sp.
Staghorn Sumac	SH	Rhus typhina L.
Striped Maple	ST	Acer pensylvanicum L.
Sugar Maple	SM	Acer saccharum Marsh.
Trembling Aspen	TA	Populus tremuloides Michx.
White Ash	WA	Fraxinus americana L.
White Birch	WB	Betula papyrifera Marsh.
Willow	WI	Salix Sp..
Yellow Birch	YB	Betula alleghaniensis Britton

COMMON NAME WOODY SHRUBS	CODE	LATIN NAME(S)
Bayberry	BA	Unclassified
Blackberry	BL	could be several for some...
Blueberry	BB	
Choke Berry	CB	
Currants	CU	
Dogwood (Red Osier)	DW	
Dogwood (Alternate-leaved)	DA	
Dogwood (Round-leaved)	DR	
Elder (Common	EB	
Elder (Red-berried)	ER	
Ground Hemlock (Yew)	GH	
Hawthorns	HT	
Hazelnut	HN	
Highbush Cranberry	HC	
Hobble Bush	HO	
Holly (Canada, Winterberry)	HO	
Holly (False)	CH	
Honeysuckle (Fly)	HW	
Huckleberry	HB	
Juniper (Ground & Creeping)	JU	
Labrador Tea	LT	
Lambkill	LK	
Leatherleaf	LL	
Other Woody Shrubs	OW	
Raspberry	RB	
Rhodora	RH	
Roses	RW	
Sweet Fern	SF	
Witch Hazel	WH	
Witherod	WR	

APPENDIX II

Field Tally Sheets

#1 Merchantable Trees 48

#2 Saplings 49

#3 Ground Cover and Vegetation 50

#4 Hardwood Sawlogs 51

#5 Coarse Woody Debris 52

#6 Amendments 53

#7 Dropped, no longer required

#8 Plot Location Sketch 54

NSDNR Forest Inventory Plot **Merchantable Trees** **Tally Sheet # 1**

Plot Number		**Type Cut**		**Treatment**	
Date (Y/M/D)		**Age Cut**		**Cruiser #**	

All Trees												Dead Trees				
Tree (#)	Specie (intl)	DBH (0.0) (cm)	Status (code)	Quad (code)	Damage (code)	Prod (code)	Tagd? (y/n)	Ht (0.0) (m)	Bole (m)	Hlth (code)	Crown (code)	Top Dia. (cm)	Decay Class (code)	Ants? (y/n)	Death Cause (code)	Lean Angle (deg)

NSDNR Forest Inventory Plot **Saplings** **Tally Sheet # 2**

Plot #	Date (Y/M/D)	Cruiser #

DBH Class (cm)	Specie	Ht (m)	Specie	Ht (m)	Specie	Ht (m)	Specie	Ht (m)	Sp	Ht m	Sp	Ht m	Sp	Ht m	Sp	Ht m	Sp	Ht m	Sp	Ht m
04																				
06																				
08																				

Land Capability Trees			
Tree/PDR	# or Specie	BH age (yr)	Ht. (m)
A - 555			
B - 556			
C - 557			

When locating Land Capability Trees off of the plot, record the distance (m) and bearing (azimuth) to each tree on the table below.

Age of Trees of Av. Basal Area	
Tree #	Age

	Tree #	Bearing (Azimuth)	Distance (m)
Location of	555		
LC trees off	556		
the plot	557		

Biased? Remarks:

NSDNR Forest Inventory Plot Ground Cover and Vegetation Tally Sheet # 3

PLOT #

GROUND COVER

GROUP	PRESENCE OF GROUND COVER (%)				
	NONE (1) (0)%	SCATTERED (2) (1-10)%	LOW (3) (11-40)%	MEDIUM (4) (41-70)%	HIGH (5) (71-100)%
LEAF LITTER					
NEEDLE LITTER					
SLASH/WOODY DEBRIS					
CLUB MOSS					
OTHER MOSS					
FERNS					
HERBS					
SEDGES & GRASSES					
LICHEN					
BARE MINERAL SOIL					
WATER/SNOW					
UNCLASSIFIED					

STONINESS

Distance between stones

(0)	>25cm	
(1)	8-25m	
(2)	1-8m	
(3)	50cm-1m	
(4)	50cm-	
(5)	<10cm	

Avg Stone Size-0.1m

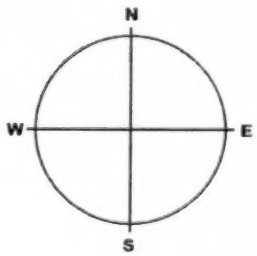
Bedrock: % of plot

Duff Depth (cm)

10 SQUARE METER SUB PLOT

VEG. (Code)	DENSITY (Dot Tally)	TOTAL (#)	AVG. HT (cm)

REFLECTION	
High (1)	
Med. (2)	
Low (3)	



PLOT ASPECT (Deg Azm)

SLOPE (%)

SOIL DRAINAGE			COMMENTS
(1)	Excessive		
(2)	Well		
(3)	Imperfectly		
(4)	Poorly		

10 SQUARE METER SUB PLOT

	DEAD STANDING SAPLINGS				DEAD STANDING WOODY BEG.			
	F.H.C. 1	F.H.C. 2	F.H.C.3		F.H.C. 1	F.H.C. 2	F.H.C. 3	
	Needle Retention		HWD		Needle Retention		HWD	
	SW>50%	SW<50%			SW>50	SW<50		
No. Stems				No. Stems				
Av Ht - 0.1m				Av Ht - cm				

NSDNR Forest Inventory Plot **Hardwood Sawlogs** **Tally Sheet # 4**

PLOT #	MAPSHEET	STAND	CRUISER #

Tree		Sweep ?		Stump to Start (Full Ft.)
Species		(min 8')		Stump to Stop (Full Ft.)
DBH (cm)				Deflection (inches)
Stump Ht. (in.)				
Top Dia @ 12' (in)		Crook?		Stump to Start (Full Ft.)
Top Dia @ 16' (in)				Deflection (inches)
Total Merch Sawlog (ft)				
Top Dia of Total Sawlog (in)		Straight		Stump to Start (Full Ft.)
		Seam		Stump to Stop (Full Ft.)
		with Rot?		Width of Seam (Full Ins.)

Scaleable Defects

If "yes" - - - - - ->
(Result to nearest foot)

If "No" go to Grade Defects

	TYPE of Defect	LENGTH Stump-Start	LENGTH Stump-Stop	
1				
2				
3				**00**
4				
5				

AT THIS POINT THE CRUISER WILL MARK THE GRADING FACE WITH A +

Grade Defects

If "yes" - - - - - ->
(Result to nearest 1/10 foot)

If "No" you are done the sawlog

	TYPE of Defect	LENGTH Stump-Start	LENGTH Stump-Stop	
1				
2				
3				**0.0**
4				
5				

Potential Hardwood Sawlogs

Tree (#)	Class 2 Rot (#)	Deflection (inches) Sweep	Deflection (inches) Crook	Defects (count)	Tree (#)	Class 2 Rot (#)	Deflection (inches) Sweep	Deflection (inches) Crook	Defects (count)

NSDNR Forest Inventory Plot — Coarse Woody Debris — Tally Sheet # 5

PLOT #	DATE	CRUISER #

Line # 1 — **Slope***

CWD	Species (initial)	Diameter (cm)	CWD Angle** (degree)	Decay CL (code)
1				
2				
3				
4				
5				
6				
7				
8				

Line # 2 — **Slope***

CWD	Species (initial)	Diameter (cm)	CWD Angle** (degree)	Decay CL (code)
1				
2				
3				
4				
5				
6				
7				
8				

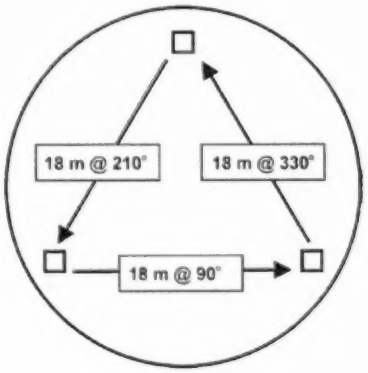
Line # 3 — **Slope***

CWD	Species (initial)	Diameter (cm)	CWD Angle** (degree)	Decay CL (code)
1				
2				
3				
4				
5				
6				
7				
8				

*Slope is not necessary if less than 20% (11.5 degrees)

**Angle is not necessary if less than or equal to 20 degrees (36%)

Code	Decay Description;
1	bark on, hard bole, round, twigs and branches present and supporting log partly off ground
2	bark flaking, mostly hard bole (little decay), round, few branch stubs, flat on ground
3	bark mostly gone, soft bole, oval, sinking into the ground



COMMENTS

NSDNR Forest Inventory Plot **Amendments** **Tally Sheet # 6**

Plot #	Date	Cruiser #

Aspect (azimuth)	Slope %	Type Cut (code)	Age Cut (yrs)	Owner (code)	Treat (code)	Year (yr)

Tree No.	Tree Quad	Spec.	DBH (cm)	Total Ht (m)	Bole Ht (m)	Crown Class	Tree Damage	Tree Status	Year	Remarks

Additional Comments

NSDNR Forest Inventory Plot **Plot Location Sketch** **Tally Sheet # 8**

Plot (#) _____

Map Sheet (#) _____

Photo Number _____

Atlas Pg _____ Grid Lg: _____ Sm: _____

Plot N _____

E _____

Mag. Azimuth to Plot _____

Distance to Plot _____

Tie	
Witness Trees	N

N

↑

Date: Modified: Artist:

APPENDIX III

Cruising Aids:

i) Code Sheet for Data Recorder 56

ii) Slope corrections 57

iii) Basal Area by Diameter 58

iv) Sheet to compute tree of average Basal Area 61

FOREST INVENTORY PLOT: PDR Code Sheet

SPECIES

PA	Austrian Pine
BF	Balsam Fir
BS	Black Spruce
DF	Douglas Fir
EC	Eastern Cedar
EH	Eastern Hemlock
EL	European Larch
JP	Jack Pine
NS	Norway Spruce
OS	Other Softwood (Dead Only)
RP	Red Pine
RS	Red Spruce
SP	Scots Pine
SS	Sitka Spruce
TL	Tamarack Larch
WL	Western Larch
WS	White Spruce
WP	White Pine
WE	American Elm
AL	Alder
AP	Apple
BP	Balsam Poplar
BW	Basswood
BE	Beech
BA	Black Ash
BC	Black Cherry
CC	Choke Cherry
GB	Grey Birch
IW	Ironwood
LA	Large Tooth Aspen
MA	Mountain Ash
MM	Mountain Maple
OH	Other Hardwood (Dead Only)
PC	Pin Cherry
RO	Red Oak
RM	Red Maple
SB	Serviceberry (Shadbush)
SH	Staghorn Sumac
ST	Striped Maple
SM	Sugar Maple
TA	Trembling Aspen
WA	White Ash
WB	White Birch
WI	Willow
YB	Yellow Birch
BY	Bayberry
BL	Blackberry
BB	Blueberry
CB	Chokeberry
CU	Currants
DW	Dogwood (Red Osier)
DA	Dogwood (Alternate-leaved)
DR	Dogwood (Round-leaved)
EB	Elder (Common)
ER	Elder (Red-berried)
GH	Ground Hemlock (Yew)
HT	Hawthorns
HN	Hazelnut
HC	Highbush-cranberry
HO	Hobble-bush
CH	Holly (Canada, Winterberry)
HF	Holly (False)
HS	Honeysuckle (Fly)
HB	Huckleberry
JU	Juniper (Ground & Creeping)
LT	Labrador-tea
LK	Lambkill
LL	Leather-leaf
OW	Other Woody Shrubs
RB	Raspberry
RH	Rhodora
RW	Roses
SF	Sweet Fern
WH	Witch-hazel
WR	Witherod (Wild Raison)

STATUS

1	Live
2	Dead (Standing)
3	Ingrowth
4	Cut
5	Dead (Down)

QUADRANT

1	North East
2	South East
3	South West
4	North West

PRODUCT

S1	SW Sawlog 1
S2	SW Sawlog 2
S3	SW Sawlog 3
RW	Round
CW	Cull Wood
SL	HW Sawlog
CT	Cut

DEAD STANDING TREE DECAY

1	Recently dead, branches and twigs intact, bark on, no decay resulting from mortality
2	Dead for a number of years, shedding fine twigs and branches, bark loose and flaking, fairly sound/windfirm bole has signs of decay/rot in sapwood or heartwood that was sound at time of mortality
3	Advanced decay/rot in bole, most of bark flaking off or absent, stability declining

CAUSE OF DEATH

10	Unknown
11	Wind throw (roots tipped up)
12	Wind breakage
13	Insect
14	Disease
15	Animal (Porcupine, Human, etc
16	Fire

HW SCALE DEFECT

10	Butt Bulge
11	Butt Scar with Rot
12	Canker with Rot
13	Hole
14	Unsound Knot
15	Stem Bulge
16	Scars and wound w/Rot
17	Straight Seam, No Rot
18	Spiral Seam, No Rot
19	Spiral Seam, w/Rot
20	False Tinder Fungus
21	Mossy-Top Fungus
22	Spine-Tooth Fungus
23	Coal Fungus
24	Canker Rot
25	Cinder Conk
26	Artist's Conk
27	Sulphur Fungus
28	Tinder Fungus

CROWN CLASS

0	Broken or Dead Top
1	Dominant
2	Co-dominant
3	Intermediate
4	Suppressed
5	Wolf Tree
6	Cut
7	Dead

TREE HEALTH

1	Good	4	Cut
2	Fair	5	Dead
3	Poor		

HW GRADE DEFECT

10Bark Distortion
11Bird Pecks (old)
12High Bump
13Medium Bump
14Low Bump
15Butt Bulge
16Butt Scar
17Burl
18Canker
19Conk
20Corky Bark
21Adventitious Twig
22Flutes
23Fork
24Galls
25Holes
26Knots
27Limbs
28Overgrowths
29Seams
30Stem Bulge
31Stem Lesion
32Worm Holes
33Wounds

TREE DAMAGE

BI	Bird (Feed Holes)
BU	Burl
BT	Broken Top
DI	Disease
DT	Dead Top
EC	Excessive Crook
EB	Excessive Lean
EL	Excessive Limbs
ES	Excessive Sweep
FR	Frost
IB	Insect Boring
IS	Ice/Snow
ME	Mechanical (Scraping)
MT	Multiple Top (softwood)
NL	Broken Top - New Leader
PP	Porcupine
RT	Rot Present
SM	Seam
SI	Sirococcus
WT	Wind Throw
WW	White Pine Weevil
ND	No Damage
XX	Exit
B1	Spruce Budworm 0-33%
B2	Spruce Budworm 34-66%
B3	Spruce Budworm 67-100%
G1	Gypsy Moth 0-33%
G2	Gypsy Moth 34-66%
G3	Gypsy Moth 67-100%
H1	Hemlock Looper 0-33%
H2	Hemlock Looper 34-66%
H3	Hemlock Looper 67-100%
M1	Tussock Moth 0-33%
M2	Tussock Moth 34-66%
M3	Tussock Moth 67-100%
S1	Sawflies 0-33%
S2	Sawflies 34-66%
S3	Sawflies 67-100%
T1	Forest Tent Cap. 0-33%
T2	Forest Tent Cap 34-66%
T3	Forest Tent Cap. 67-100%

Down CWD Decay Class

1	bark on, hard bole, round, twigs and branches present and supporting log partly off ground,
2	bark flaking, mostly hard bole (little decay), round, few branch stubs, flat on ground,
3	bark mostly gone, soft bole, oval, sinking into ground.

NS COUNTY

J	Annapolis
B	Antigonish
V	Cape Breton
E	Colchester
D	Cumberland
N	Digby
C	Guysborough East
W	Guys. St. Mary's
G	Halifax East
H	Halifax West
F	Hants
S	Inverness
K	Kings
M	Lunenburg
A	Pictou
L	Queens
U	Richmond
R	Shelburne
T	Victoria
P	Yarmouth

LAND OWNER (old)

150	Federal (5)
151	Crown (1)
153	Native Lands (5)
154	Large Private (2)
155	Industrial Managed (2)
156	Small Private (Managed) (3)
157	Other (Small Private) (3)
158	DND (5)
159	Federal Parks (5)
162	Leased Crown (1)

TYPE CUT

0	No Cut
1	Clear Cut
2	Partial Cut

PLOT TREATMENT

00	Natural
02	Artificial Regeneration
05	Cleaning/Thinning
06	Harvest
07	Pre merchantable Thinning
08	Commercial Thinning

DRAINAGE

1	Excessively Drained: Thin LFH, Soil: very bright colors, No mottling, coarse sand texture.
2	Well Drained: Thin LFH, Soil has bright Colours, No soil mottling, variable texture.
3	Imperfectly Drained: Moderately deep LFH, Dull Soil Colours, Mottling "B" horizon, Sphagnum moss in hollows.
4	Poorly Drained: Deep LFH, White Soil Colours, Mottling "A" and "B" horizons, Sphagnum moss common.

STONINESS

	Distance between Stones
0	> 25 m
1	8 - 25 m
2	1 - 8 m
3	50 cm - 1 m
4	10 cm - 50 cm
5	<10 cm
9	No Stones

AMOUNT OF GROUND COVER

1	None
2	Scattered (1-10%)
3	Low (11-40%)
4	Medium (41-70%)
5	High (71-100%)

April 8, 2002

Adjustment for Forest Inventory Plot Radius to correct for Slope											
Angle (degree)	Slope (%)	Radius (m)	Angle (degree)	Slope (%)	Radius (m)	Angle (degree)	Slope (%)	Radius (m)	Angle (degree)	Slope (%)	Radius (m)
1	2	11.35	16	29	11.81	31	60	13.24	46	104	16.34
2	3	11.36	17	31	11.87	32	62	13.38	47	107	16.64
3	5	11.37	18	32	11.93	33	65	13.53	48	111	16.96
4	7	11.38	19	34	12.00	34	67	13.69	49	115	17.30
5	9	11.39	20	36	12.08	35	70	13.86	50	119	17.66
6	11	11.41	21	38	12.16	36	73	14.03	51	123	18.04
7	12	11.44	22	40	12.24	37	75	14.21	52	128	18.44
8	14	11.46	23	42	12.33	38	78	14.40	53	133	18.86
9	16	11.49	24	45	12.42	39	81	14.60	54	138	19.31
10	18	11.53	25	47	12.52	40	84	14.82	55	143	19.79
11	19	11.56	26	49	12.63	41	87	15.04	56	148	20.30
12	21	11.60	27	51	12.74	42	90	15.27	57	154	20.84
13	23	11.65	28	53	12.85	43	93	15.52	58	160	21.42
14	25	11.70	29	55	12.98	44	97	15.78	59	166	22.04
15	27	11.75	30	58	13.11	45	100	16.05	60	173	22.70

Basal Area in m^2 from Tree diameter (eg. a 17.4 cm diameter tree has a BA of 0.0238 m^2)

Dia (cm)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
9	0.0064	0.0065	0.0066	0.0068	0.0069	0.0071	0.0072	0.0074	0.0075	0.0077
10	0.0079	0.0080	0.0082	0.0083	0.0085	0.0087	0.0088	0.0090	0.0092	0.0093
11	0.0095	0.0097	0.0099	0.0100	0.0102	0.0104	0.0106	0.0108	0.0109	0.0111
12	0.0113	0.0115	0.0117	0.0119	0.0121	0.0123	0.0125	0.0127	0.0129	0.0131
13	0.0133	0.0135	0.0137	0.0139	0.0141	0.0143	0.0145	0.0147	0.0150	0.0152
14	0.0154	0.0156	0.0158	0.0161	0.0163	0.0165	0.0167	0.0170	0.0172	0.0174
15	0.0177	0.0179	0.0181	0.0184	0.0186	0.0189	0.0191	0.0194	0.0196	0.0199
16	0.0201	0.0204	0.0206	0.0209	0.0211	0.0214	0.0216	0.0219	0.0222	0.0224
17	0.0227	0.0230	0.0232	0.0235	0.0238	0.0241	0.0243	0.0246	0.0249	0.0252
18	0.0254	0.0257	0.0260	0.0263	0.0266	0.0269	0.0272	0.0275	0.0278	0.0281
19	0.0284	0.0287	0.0290	0.0293	0.0296	0.0299	0.0302	0.0305	0.0308	0.0311
20	0.0314	0.0317	0.0320	0.0324	0.0327	0.0330	0.0333	0.0337	0.0340	0.0343
21	0.0346	0.0350	0.0353	0.0356	0.0360	0.0363	0.0366	0.0370	0.0373	0.0377
22	0.0380	0.0384	0.0387	0.0391	0.0394	0.0398	0.0401	0.0405	0.0408	0.0412
23	0.0415	0.0419	0.0423	0.0426	0.0430	0.0434	0.0437	0.0441	0.0445	0.0449
24	0.0452	0.0456	0.0460	0.0464	0.0468	0.0471	0.0475	0.0479	0.0483	0.0487
25	0.0491	0.0495	0.0499	0.0503	0.0507	0.0511	0.0515	0.0519	0.0523	0.0527
26	0.0531	0.0535	0.0539	0.0543	0.0547	0.0552	0.0556	0.0560	0.0564	0.0568
27	0.0573	0.0577	0.0581	0.0585	0.0590	0.0594	0.0598	0.0603	0.0607	0.0611
28	0.0616	0.0620	0.0625	0.0629	0.0633	0.0638	0.0642	0.0647	0.0651	0.0656
29	0.0661	0.0665	0.0670	0.0674	0.0679	0.0683	0.0688	0.0693	0.0697	0.0702
30	0.0707	0.0712	0.0716	0.0721	0.0726	0.0731	0.0735	0.0740	0.0745	0.0750
31	0.0755	0.0760	0.0765	0.0769	0.0774	0.0779	0.0784	0.0789	0.0794	0.0799
32	0.0804	0.0809	0.0814	0.0819	0.0824	0.0830	0.0835	0.0840	0.0845	0.0850
33	0.0855	0.0860	0.0866	0.0871	0.0876	0.0881	0.0887	0.0892	0.0897	0.0903
34	0.0908	0.0913	0.0919	0.0924	0.0929	0.0935	0.0940	0.0946	0.0951	0.0957
35	0.0962	0.0968	0.0973	0.0979	0.0984	0.0990	0.0995	0.1001	0.1007	0.1012
36	0.1018	0.1024	0.1029	0.1035	0.1041	0.1046	0.1052	0.1058	0.1064	0.1069
37	0.1075	0.1081	0.1087	0.1093	0.1099	0.1104	0.1110	0.1116	0.1122	0.1128
38	0.1134	0.1140	0.1146	0.1152	0.1158	0.1164	0.1170	0.1176	0.1182	0.1188
39	0.1195	0.1201	0.1207	0.1213	0.1219	0.1225	0.1232	0.1238	0.1244	0.1250
40	0.1257	0.1263	0.1269	0.1276	0.1282	0.1288	0.1295	0.1301	0.1307	0.1314

Dia (cm)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
41	0.1320	0.1327	0.1333	0.1340	0.1346	0.1353	0.1359	0.1366	0.1372	0.1379
42	0.1385	0.1392	0.1399	0.1405	0.1412	0.1419	0.1425	0.1432	0.1439	0.1445
43	0.1452	0.1459	0.1466	0.1473	0.1479	0.1486	0.1493	0.1500	0.1507	0.1514
44	0.1521	0.1527	0.1534	0.1541	0.1548	0.1555	0.1562	0.1569	0.1576	0.1583
45	0.1590	0.1598	0.1605	0.1612	0.1619	0.1626	0.1633	0.1640	0.1647	0.1655
46	0.1662	0.1669	0.1676	0.1684	0.1691	0.1698	0.1706	0.1713	0.1720	0.1728
47	0.1735	0.1742	0.1750	0.1757	0.1765	0.1772	0.1780	0.1787	0.1795	0.1802
48	0.1810	0.1817	0.1825	0.1832	0.1840	0.1847	0.1855	0.1863	0.1870	0.1878
49	0.1886	0.1893	0.1901	0.1909	0.1917	0.1924	0.1932	0.1940	0.1948	0.1956
50	0.1964	0.1971	0.1979	0.1987	0.1995	0.2003	0.2011	0.2019	0.2027	0.2035
51	0.2043	0.2051	0.2059	0.2067	0.2075	0.2083	0.2091	0.2099	0.2107	0.2116
52	0.2124	0.2132	0.2140	0.2148	0.2157	0.2165	0.2173	0.2181	0.2190	0.2198
53	0.2206	0.2215	0.2223	0.2231	0.2240	0.2248	0.2256	0.2265	0.2273	0.2282
54	0.2290	0.2299	0.2307	0.2316	0.2324	0.2333	0.2341	0.2350	0.2359	0.2367
55	0.2376	0.2384	0.2393	0.2402	0.2411	0.2419	0.2428	0.2437	0.2445	0.2454
56	0.2463	0.2472	0.2481	0.2489	0.2498	0.2507	0.2516	0.2525	0.2534	0.2543
57	0.2552	0.2561	0.2570	0.2579	0.2588	0.2597	0.2606	0.2615	0.2624	0.2633
58	0.2642	0.2651	0.2660	0.2669	0.2679	0.2688	0.2697	0.2706	0.2715	0.2725
59	0.2734	0.2743	0.2753	0.2762	0.2771	0.2781	0.2790	0.2799	0.2809	0.2818
60	0.2827	0.2837	0.2846	0.2856	0.2865	0.2875	0.2884	0.2894	0.2903	0.2913
61	0.2922	0.2932	0.2942	0.2951	0.2961	0.2971	0.2980	0.2990	0.3000	0.3009
62	0.3019	0.3029	0.3039	0.3048	0.3058	0.3068	0.3078	0.3088	0.3097	0.3107
63	0.3117	0.3127	0.3137	0.3147	0.3157	0.3167	0.3177	0.3187	0.3197	0.3207
64	0.3217	0.3227	0.3237	0.3247	0.3257	0.3267	0.3278	0.3288	0.3298	0.3308
65	0.3318	0.3329	0.3339	0.3349	0.3359	0.3370	0.3380	0.3390	0.3400	0.3411
66	0.3421	0.3432	0.3442	0.3452	0.3463	0.3473	0.3484	0.3494	0.3505	0.3515
67	0.3526	0.3536	0.3547	0.3557	0.3568	0.3578	0.3589	0.3600	0.3610	0.3621
68	0.3632	0.3642	0.3653	0.3664	0.3675	0.3685	0.3696	0.3707	0.3718	0.3728
69	0.3739	0.3750	0.3761	0.3772	0.3783	0.3794	0.3805	0.3816	0.3826	0.3837
70	0.3848	0.3859	0.3870	0.3882	0.3893	0.3904	0.3915	0.3926	0.3937	0.3948
71	0.3959	0.3970	0.3982	0.3993	0.4004	0.4015	0.4026	0.4038	0.4049	0.4060
72	0.4072	0.4083	0.4094	0.4106	0.4117	0.4128	0.4140	0.4151	0.4162	0.4174
73	0.4185	0.4197	0.4208	0.4220	0.4231	0.4243	0.4254	0.4266	0.4278	0.4289

Dia (cm)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
74	0.4301	0.4312	0.4324	0.4336	0.4347	0.4359	0.4371	0.4383	0.4394	0.4406
75	0.4418	0.4430	0.4441	0.4453	0.4465	0.4477	0.4489	0.4501	0.4513	0.4525
76	0.4536	0.4548	0.4560	0.4572	0.4584	0.4596	0.4608	0.4620	0.4632	0.4645
77	0.4657	0.4669	0.4681	0.4693	0.4705	0.4717	0.4729	0.4742	0.4754	0.4766
78	0.4778	0.4791	0.4803	0.4815	0.4828	0.4840	0.4852	0.4865	0.4877	0.4889
79	0.4902	0.4914	0.4927	0.4939	0.4951	0.4964	0.4976	0.4989	0.5001	0.5014
80	0.5027	0.5039	0.5052	0.5064	0.5077	0.5090	0.5102	0.5115	0.5128	0.5140

NSDNR Compilation Sheet to Calculate Tree of Average Basal Area

Diameter (cm)	Frequency (#)	x	BA (m^2)	=	Total (m^2)
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
Total		x	Total	=	

Diameter (cm)	Frequency (#)	x	BA (m^2)	=	Total (m^2)
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
		x		=	
Total		x	Total	=	

Total Basal Area = Avg BA

Total Frequency

m^2
#

= m^2/tree

Result: Take the average BA value and look it up in the BA table to get the diameter of the tree of average BA.

APPENDIX V

Locating and Collecting Coordinates using GPS with the MARCH II units

PLOT LOCATION, COLLECTION, DOWNLOAD

- Creating Feature List In PC-GPS 63
- Creating a Route: "PC-GPS" (Using PSP Coordinate from GIS) 64
- Using Navigate Feature To Confirm Location of Plot 65
- Gather coordinates of a static point (Forest Inventory Plot) 65
- Review Collected Data 66
- Transfer file (job) from GPS unit to PC-GPS 66

MANUALLY OBTAIN GPS DATE AND TIME OF JOB 67

CMT-FIELD QUICK REFERENCE

- Data Collection Fields 67
- Procedures 67
- Time 67
- Setup Receiver 68
- Antenna 68
- Troubleshooting 68
- Important Keys to Know 69
- Tracking Status Indicator 70

Locating and Collecting Coordinates using GPS with the MARCH II units.

DNR has purchased March II units for use in the locating and data collection of coordinates for the Forest Inventory Plots. The use of this technology should allow us to eliminate the use of tie lines, and in future, we should only require paint at the plot and perhaps at a tie point where the cruiser leaves their vehicle. The following is a list of procedures and pointers to help the cruisers locate and map their plot centres using the MARCH II units.

CREATING A FEATURE LIST IN PC-GPS

This operation creates a set of orders to the GPS unit which instructs the unit to gather the coordinates of a static point for 2 minutes in length.

1 Double click on PC-GPS icon on desk top
2 Click on lists at Menu Bar at top of screen
3 Click on feature list
4 At menu dialogue box change file name to FIP _____.FBR, then hit "OK"
5 At feature list box click on blue space under feature and type in FIP (Hit "Enter")
6 Click on arrow in Type Box and select "Point"
7 Click on "INTVL/Sess" box containing the #20. Type in 120, and hit "Enter"
8 In attribute box type in FIP
9 In value box type in the list of plots using the down arrow between plot #'s
10 When plot #'s have been entered. Hit "enter" key and then "OK"
11 Return to main menu

Transferring "FEATURE LIST" to March II unit

1 Connect communication cable to the com-1 port on the PC and the March II unit
2 At main menu press F3 (xfer) on March 11
Click on F1 key until the file type shows "Feature List"
3 Open up PC-GPS to main menu and click on "file transfer"- "send"
4 Click on "PC-GPS"in directory box
5 In file name box, type in *.fbr
6 Double click on PC-GPS in the directory box
7 Single click on feature file that appears under the file name box(it will have a .fbr extension)
8 Click on "receive" (f3) on the March II unit
9 Click on "ok" on PC-GPS. It will now show how many bytes were transferred.(on PC-GPS)
10 Press escape key on March II unit until you return to the main menu

CREATING A ROUTE : "PC-GPS" (USING PSP COORDINATE FROM GIS)

The cruiser must first create a route in the PC to store all the new FIP'S and their coordinates. Use the following to create a route:

1 At main menu, click on "lists"- " routes"
2 Click on "file" - "new"
3 Click on "edit" - "add"
4 At (edit waypoint) information box, hit tab key to move cursor to "name" box.
5 Enter FIP_____
6 Hit tab key twice
7 Enter northing
8 Hit tab key

9 Enter easting
10 hit tab
11 Click on save and go to next button
12 Repeat steps four to thirteen until all coordinates have been entered
13 Click on "file" - "save as"
14 Enter FIP_____ in file name box
15 Click on "ok"
16 Return to main menu

WARNING: DO NOT PRESS ESC AT MAIN MENU (you will go to DOS) AND YOU WILL THEN HAVE TO RESET THE UNIT

Transferring "ROUTE" to GPS unit.

This is the procedure used to download the initial coordinates from the computer to their MARCH II units. This procedure should be carried out prior to going to the field. If the cruiser is establishing a new plot, the cruiser can use this data to ensure they are close to the FIP point prior to establishing the centre stake. Using the navigate feature along with the FIP coordinates stored in the route feature, the technician can confirm that he is indeed in close proximity(within 100 meters) of the intended GIS location The procedure is as follows:

1 Connect communication cable to the com-1 port on the PC and the March II unit
2 At main menu press F3 (xfer)
3 Click on F1 key until file type shows "Route"
4 Open up PC-GPS to main menu and click on "file transfer"- "send"
5 Click on "PC-GPS"in directory box
6 In file name box, type in *.pat
7 Double click on PC-GPS in the directory box
8 Single click on route file that appears under the file name box(it will have a pat extension)
9 Click on "receive" (f3) on the March II unit
10 Click on "ok" on PC-GPS. It will now show how many bytes were transferred.(on PC-GPS)
11 Press escape key on March II unit until you return to the main menu

USING NAVIGATE FEATURE TO CONFIRM LOCATION OF PLOT(Establish)

i At main menu , highlight "Navigate" and press "enter"
ii Press "yes" to turn the receiver on
iii When four satellites are being successfully tracked the unit will show the navigation screen
iv Using the right arrow, change the route designation from "new" to desired route "CR??"
v Using down arrow, scroll down to "WPT"
vi Using either left or right arrow scroll through the waypoint numbers until the desired FIP number appears to the left in the "DEST" section
vii The bottom left position on the screen , [RNG (range)] shows the distance in metres or kilometres that you are from the GIS plot location
viii Any distance over 100m should prompt a re-evaluation of your ground position

GATHER COORDINATES OF A STATIC POINT (Forest Inventory Plot)

This is the procedure used to collect the Forest Inventory Plot Center stake coordinates on the March II. Once the cruiser has established the centre stake, following all protocols, the cruiser must collect the coordinates with the March II units by following these instructions:

1. At Main Menu select "Collect Data"
2. The " March II " will prompt you to turn on receiver Press "YES" [F5]
3. A) If feature is showing in feature list GOTO step 4
   B) If "none" shows in feature list, move curser to "none" and scroll with right arrow to desired feature is found in list. **Warning** the March II will not collect a point without a feature list.
4. Press [F1] " GO".
5. A rectangle appears with a file name. Replace this with FIP1234. To do this,
   (A) press the [SH] and F5 keys.
   (B) using up and down arrows toggle to desired number or letters. Choose appropriate F key to enter these choices.
   (C) Hit ESC to leave Alpha mode
   (D) To save the new file name hit Enter.
6. This accesses the "Features" screen.
7. Press Enter
8. A) At featuring screen scroll down to desired plot number if plot number is in list and hit Enter.
   B) If plot number is not in list, use up arrow to move curser up to blank position and repeat **STEP 5**. A, B, C and D.
9. At the "Featuring" screen press [F4] (store). This will activate the storing process.
10. When the data has been captured, the March 11 will go back to the "Feature" screen.
11. Hit "ESC" key until you get back to the Main Menu. To turn off receiver press the red [ON] .
12. Press [F1] (OFF) then [F5] (YES).
13. Press "ESC" key to return to Main Menu
14. Press [F1] (OFF) to turn March 11 OFF.

REVIEW COLLECTED DATA

Following capture of the coordinate points, the cruiser should follow this route to ensure the points were collected. In addition, the cruiser can get the information required for the log book. This feature can be used to check both UTC times and if the job collected data.

1. Press [F3] (LISTS) from the Main Menu.
2. Highlight **Jobs** and press [ENTER]
3. Highlight the Job of interest.
   A. For a summary of Job contents, press [F4](SUM).
   B. To view Features, press [ENTER] then [VIEW].
   C. Select **"Collected Data"** to see a list of Features.
   D. Select **"Plot"** to see a map of the Job.

TRANSFER FILE (JOB) FROM GPS UNIT TO PC-GPS

Following data collection, the March II units should upload their captured coordinates to a PC and forward this information to the Truro LAN. To upload this data to the computer, follow these instructions:

1 Connect March11 to PC with communication cable attached to com1 ports.
2. On PC-GPS main menu click on file Transfer - Receive (File Transferring box will appear).
3 Click on Change Dir box, double click on c:\ ,select desired folder and double click, then "OK"
4. On GPS unit, at main menu, click on [F4] (XFER)
5. File transfer Menu will appear, highlight desired file and press [F4] (send).
6. The file Transferring Box will display the file name and amount of bytes transferred.
7. A bar graph showing the percent of the file being down loaded is produced on the GPS screen as the transfer of files takes place.
8. To get back to Main Menu Press ESC. Key (until you get back).

MANUALLY OBTAIN GPS DATE AND TIME OF JOB

If the cruiser did not review the collected data in the field, then the following must be followed in order to get the information required for the log book. This is to be used to determine the UTC date and time from PC-GPS.

1. At Main Menu of PC-GPS, click on Job - Open.
2. Highlight the folder containing the desired FIP job
3. Double Click on desired FTR File in **C:\fip\vpdn\gps\2000 directory**. (Subject to change)
4. In Feature Update click on the coordinates button.
5. Obtain date and time of Plot. Record on sheet provided.
6. Return to main menu

CMT-FIELD QUICK REFERENCE

The following are general information items that the cruiser may wish to check on.

DATA COLLECTION FIELDS

If you don't have a Feature List, or want to map a Feature not in your list, CMT-Field will ask for the following information:

FEATURE NAME: Enter the name of the Feature.
FEATURE TYPE: Select Point, Line or Area.
Feature ID: Filled based on Feature Name.
LOGGING MODE: **DYNAMIC** - Map a line or Area.
STATIC - Occupy a point or a Line Node.
INTVL/SESSION: **INTVL** - Interval for DYNAMIC logging mode.
SESSION - Session Time for STATIC mode.

PROCEDURES

This is used to select date and time.

TIME (Receiver must be on.)

1.Select SETUP from the Main Menu
2. Select TIME/DATE from the Setup Menu.
3. Enter the correct local time and date.
4. Enter the UTC time offset:
For the Standard Time, enter-5.

For the Pacific Standard Time, enter -8.

5. **Press** [F4] (SAVE).
6. If a warning message is displayed, see the **TROUBLESHOOTING** section.

SETUP RECEIVER (receiver must be ON.)

This procedures allows you to select if the GPS collects Lat, Long, Dop limits, Altitude control, and almanac information.

1.Select SETUP from the Main Menu.
2. Select RECEIVER from the Setup menu.
3. Set LAT, LONG, DOP limits and ALT. CONTROL.
4. Toggle SEND ALM to YES.
5. Press [F4] (SAVE) to send almanac to the engine.

ANTENNA

1. Check antenna cable connection to GPS unit.
2. Is the antenna blocked from the GPS signal?

TROUBLESHOOTING

Stays in ACQ, IAC, or STS mode (doesn't track).
Do the **TIME** procedures. If this does not help, do the **SETUP RECEIVER** procedure and **ANTENNA** procedure. Make sure battery is charged.

Stays in TRK mode when tracking a lot of SV's
Check PDOP, HDOP and VDOP limits in **SETUP RECEIVER** screen. You can raise limits. Make sure the RTCM_104 filed in RS-232 Input/Output screen is set to AUTO or No.

GPS shows the wrong time.
Do TIME procedure.

You are lost in the program.
Press [ESC] until the Main Menu is displayed.

Status Indicator reads "LOW".
Charge or replace the GPS receiver battery.

Batteries do not hold a charge.
Make sure the recharger is functioning. Make sure the outlet is turned on. You may need new batteries.

Receiver battery has meaningless power reading.
Remember that you must reset it to 100% after a full charge. For MC5GPS-IC, press [SH1], [ENTER], [F2], then press [+] repeated until powermeter shows 100%.

Unit displays "WARNING, TIME OFFSET NOT EQUAL TO MC TIME - GPS TIME CONTINUED?"

This indicates that time in the GPS receiver is not the same as the time you entered. If you are sure you entered the

correct date/time, then press [F5] (YES). If you are not sure, press [F1] (NO) and double check the date/time you entered and then press [F5] (YES) when you are prompted.

IMPORTANT KEYS TO KNOW

When unit on, **[ON]** display GPS Status screen (also shows system battery power level).
[ON] + [F1] turns the GPS receiver ON/OFF.
[SH2] + [F1] displays help screen.
[SH2] + [F2] shows SV STATUS.
[SH2] + [F3] displays compass.
[satellite] [satellite] selects from options; moves cursor right/left.
[satellite] [satellite] moves the cursor between fields.
[ESC] goes to previous menu or backs out of program.
[SH1] + [ENTER] displays System Status screen.
[SH1] + [+] or [-] turns display contrast up or down.
[SH1] + [SP] toggles display backlight on/off.

Note: For March II, use [SH] instead of [SH1], [SH2].
To adjust displays contrast or backlight for MARCH II, first press [SH] + [ENTER].
[F3] + [ON] resets system.
DO NOT do this while storing data.

TRACKING STATUS INDICATOR

If indicator is not in the upper-right corner of the screen, GPS receiver is OFF. Last digit is the current PDOP.
STS - Do TIME and SETUP RECEIVER procedures.
IAC - searching for satellites.
ACQ - finding sat lites.
TRK - Tracking satellites.
N2D - Computing a 2D (poor quality) position.
N3D - Computing a 3D position.
N3C - Computing a corrected 3D position.
F3D - Storing 3D data.
F3C - Storing corrected 3D data)RTCM-104).

If the Tracking Status does not start with "F", the unit is not storing data!